No. 92-1507

Supreme Court, U.S.
FILED
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In The

Supreme Court of the United States

October Term, 1992

ALBERT L. DE GRAFFENRIED,

Petitioner,

vs.

THE UNITED STATES,

Respondent.

Petition for Writ of Certiorari to the United States Court of Appeals for the Federal Circuit

PETITION FOR WRIT OF CERTIORARI

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QUESTION PRESENTED

Whether an internal memorandum written by a patentee two years prior to the date of an eminent domain taking by the United States Government is the best indication of the value of this patent at the time of the taking?

LIST OF PARTIES

The names of all parties appear in the caption of the case.

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No.

In The

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ALBERT L. DE GRAFFENRIED,

Petitioner

vs.

THE UNITED STATES,

Respondent.

Petition for a Writ of Certiorari to the United States Court of Appeals for the Federal Circuit

PETITION FOR WRIT OF CERTIORARI

OPINIONS BELOW

1. The Liability Opinion of the United States Claims Court appears at 20 Cl. Ct. 458 and 16 USPQ 2d 1321 (1990).

2. The Accounting Opinion of the United States Claims Court appears at 25 Cl. Ct. 209 and 24 USPQ 2d 1594 (1992).

3. The Court of Appeals for the Federal Circuit affirmed the decision of the Claims Court without opinion.

STATEMENT OF JURISDICTION

The Court of Appeals entered judgment affirming the United States Claim Court without an opinion on December 17, 1992. The Supreme Court has jurisdiction to review this judgment under 28 U.S.C. § 1254(1).

CONSTITUTIONAL PROVISIONS AND STATUTE INVOLVED

U.S. Const. Amend. V:

> No person shall be held to answer for a capital, or otherwise infamous crime, unless on a presentment or indictment of a Grand Jury, except in cases arising in the land or naval forces, or in the Militia, when in actual service in time of War or public danger; nor shall any person be subject for the same offence to be twice put in jeopardy of life or limb; nor shall be compelled in any criminal case to be a witness against himself, nor be deprived of life, liberty, or property, without due process of law; nor shall private property be taken for public use, without just compensation.

28 U.S.C. § 1498(a):

> (a) Whenever an invention described in and covered by a patent of the United States is used or manufactured by or for the United States without license of the owner thereof or lawful right to use or manufacture the same, the owner's remedy shall be by action against the United States in the United States Claims Court

> for the recovery of his reasonable and entire compensation for such use and manufacture. . . .

STATEMENT OF THE CASE

1. Albert L. de Graffenried, (hereinafter "de Graffenried"), the petitioner herein, is an individual citizen who is now 71 years old.

2. In 1962 de Graffenried submitted a proposal to the Watervliet Arsenal of the Department of the Army located in Watervliet, New York pursuant to a Request for Proposals for a runout controller. A runout controller is a device used in deep boring operations to control the straightness of a bore when boring, for example, cannon barrels. (This technology is more specifically described in the Liability Opinion attached in the Appendix at pp. 7a-8a.)

3. Pursuant to the proposals received by the Watervliet Arsenal, the United States Government (hereinafter "Government"), awarded a contract for a runout controller not to de Graffenried but to Bergen Research Corporation who had proposed a runout controller utilizing a taut wire (Liability Op. 14a).

4. Unable to develop a workable system utilizing the technology proposed by Bergen Research, the Government began using de Graffenried's invention (Liability Op. 15a).

5. A patent application had been filed by de Graffenried for the runout controller in 1962 and the patent for this runout controller issued in 1965 (Liability Op. 16a).

6. The Government first used de Graffenried's invention prior to the date the patent issued in 1965 (Accounting Op. 81a);

therefore, the time of the eminent domain taking by the Government occurred when the patent issued in 1965.

7. When de Graffenried failed to sell his runout controller proposal to the Watervliet Arsenal in 1962, de Graffenried approached private industry.

8. In 1963, two years prior to the date the patent issued, de Graffenried was having preliminary negotiations with the Westinghouse Corporation (Accounting Op. 94a).

9. During this same year, 1963, de Graffenried wrote in an internal memorandum to a family member, his brother, setting forth terms of a possible offer to Westinghouse. This internal memorandum was never intended to be submitted to Westinghouse, because it was written on de Graffenried's dead uncle's stationery.

10. De Graffenried never heard back from his brother.

11. Although there is no evidence that this offer was actually delivered to Westinghouse, the Claims Court[1] found that it must have been delivered to Westinghouse (Accounting Op. 95a, n. 3).

12. Nothing resulted from the negotiations with Westinghouse in 1963 and Westinghouse never purchased any runout controllers from de Graffenried.

13. The present lawsuit was filed on October 6, 1980 pursuant to 28 U.S.C. § 1498.

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1. The United States Claims Court has recently changed its name to the United States Court of Federal Claims but throughout this brief petitioner will refer to this Court as the Claims Court.

14. The present lawsuit was bifurcated into two phases — a liability phase and an accounting phase.

15. A liability trial was held in April of 1989 and the Claims Court held de Graffenried's patent was a pioneer patent (Liab. Op. 65a) and that this patent was valid and infringed (Liab. Op. 77a).

16. It is undisputed that de Graffenried has never built or sold a runout controller and that the invention, on the date the patent issued, *i.e.* the date of taking, was "undeveloped".

17. It is also undisputed that as of the date the patent issued (the date of taking) the de Graffenried patent had very little market value, but what value there was resided chiefly in the possibility of its use by the Government.

18. It is also undisputed that the Government, in using the de Graffenried patent after the patent issued, realized important cost savings (Liab. Op. 42a).

19. The accounting trial in this case was held in May of 1991. The Claims Court found that the best evidence of the value of de Graffenried's invention at the time of the taking in 1965 (when the patent issued) was the 1963 internal memorandum to his brother regarding the negotiations with Westinghouse (Accounting Op. 103a). Subsequent to the accounting trial, the Claims Court awarded Judgment to de Graffenried in the amount of $88,100.00 for the taking plus an amount of $453,900.33 as prejudgment interest for a total of $542,000.33.

20. De Graffenried appealed the decision reached by the Claims Court in its accounting opinion to the Court of Appeals for the Federal Circuit, and the government appealed a portion of the liability decision to the Court of Appeals for the Federal Circuit. The decision of the Claims Court was affirmed, without opinion, in both appeals to the Court of Appeals for the Federal Circuit.

REASONS FOR GRANTING THE WRIT

I.

PREFACE

This Petition for Certiorari seeks review of a decision by the Court of Appeals for the Federal Circuit affirming, without an opinion, the decision of the United States Claims Court reached on an action by de Graffenried brought under 28 U.S.C. § 1498 for unauthorized use of a patented invention by the Government.

The Claims Court had previously found that Government liable for infringement of U.S. Patent No. 3,217,568, de Graffenried's patent. No review of this decision is sought. However a review of the decision reached by the Federal Circuit and the Claims Court as to the accounting proceedings is sought in this Petition.

The nature of the remedy under 28 U.S.C. § 1498 is that when a patented device or invention is made or used by or for the United States, the Government takes by eminent domain a compulsory, compensable license in the patent. The patentee obtains his Fifth Amendment (U.S. Const. Amend. V) just compensation for that taking through an action brought under 28 U.S.C. § 1498. *Calhoun v. United States,* 453 F.2d 1385, 1391 (Ct. Cl. 1972).

The Fifth Amendment requires "just compensation" for the taking of private property for public use. Basic equitable principles of fairness exist in eminent domain takings. *Almota Farmers E. & W. Co. v. United States,* 409 U.S. 470, 478, 35 L. Ed. 2d 1, 93 S. Ct. 791 (1973). Just compensation means the full monetary equivalent of the property taken. *Id.* at 473. *See also, United States v. Virginia E. & P. Co.,* 365 U.S. 624, 631, 5 L. Ed. 2d 838, 81 S. Ct. 784 (1961).

Liability of the Government in patent taking cases ordinarily attaches when the taking occurs. *Textronics, Inc. v. United States,* 575 F.2d 832, 837 (Ct. Cl. 1978).

II.

VALUE AT TIME OF TAKING

Previous decisions of this Court relating to eminent domain takings by the Government, make clear that the value of the thing taken is to be determined at the time of the taking. *United States v. Miller,* 317 U.S. 369, 374, 87 L. Ed. 336, 63 S. Ct. 276 (1943); *United States v. 50 Acres of Land,* 469 U.S. 24, 29, 83 L. Ed. 2d 376, 105 S. Ct. 451 (1984); *United States v. Reynolds,* 397 U.S. 14, 16, 25 L. Ed. 2d 12, 90 S. Ct. 803 (1970); and *United States v. Clarke,* 445 U.S. 253, 258, 63 L. Ed. 2d 373, 100 S. Ct. 1127 (1980). In all of these cases, the eminent domain taking was related to the condemnation of land. The Claims Court has described the general rule relating to patent takings and found in *Decca Ltd. v. United States,* 640 F.2d 1156, 1167 (1980), *cert. denied,* 454 U.S. 819 (1984) that:

> One of the two components of "reasonable and entire" [language used in 28 U.S.C. § 1498] compensation for the license is the value of the license, determined ordinarily as of the time the Government takes the license.

III.

DETERMINATION OF VALUE AT TIME OF TAKING

If there is an established royalty, established prior to the time when the license is taken by the Government, this established royalty is used, virtually without exception, to determine the value

of the license taken by the Government. *Decca, supra,* at 1167. Where there is no established royalty, as is the case here (Accounting Op. 92a), the Court may allow a reasonable royalty determined by considering the "nature of the invention, its utility and advantages, and the extent of use involved". *Dowagiac Mfg. Co. v. Minnesota Moline Plow Co.,* 235 U.S. 641, 648, 59 L. Ed. 398, 404, 35 S. Ct. 221 (1915).

IV.

THE SUBSEQUENT USE THAT HAS BEEN MADE OF AN "UNDEVELOPED" PATENT IS A LEGITIMATE AID TO THE APPRAISAL OF THE VALUE OF THE PATENT AT THE TIME OF THE TAKING.

In *Sinclair Refining Co. v. Jenkins Petroleum Process Co.,* 289 U.S. 689 (1933) this Court reviewed a dismissal of a bill of discovery in aid of an action at law. Here this Court considered the issue of the value of a patent. In this case, discovery had been opposed by one of the parties reasoning that the sales of the patented device had no relation to the value of the patent and that evidence of such sales would be inadmissible if offered. This position was upheld by the District Court but reversed by the Court of Appeals. This Court in affirming the Court of Appeals discussed the evidence to be used in determining the value of an undeveloped patent which had little value for exchange stating:

> Value for exchange is not the only value known to the law of damages. There are times when heed must be given to value for use, if reparation is to be adequate. *Barker v. Lewis Storage & Transfer Co.,* 78 Conn. 198, 61 Atl. 363, 3 Ann. Cas. 889; *Green v. Boston & L.R. Co.,* 128 Mass. 221, 35 Am. Rep. 370; *Citizens' Sav. Bank & T. Co. v. Fitchburgh Mut. F. Ins.*

> *Co.*, 86 Vt. 267, 84 Atl. 970; *McAnarney v. Newark F. Ins. Co.*, 247 N.Y. 176, 184, 185, 159 N.E. 902, 56 A.L.R. 1149; *Sedgwick, supra*, pp. 504-507. An imaginary bid by an imaginary buyer, acting upon the information available at the moment of the breach, is not the limit of recovery where the subject of the bargain is an undeveloped patent. Information at such a time might be so scanty and imperfect that the offer would be nominal. The promisee of the patent has less than fair compensation if the criterion of value is a price he would have received if he had disposed of it at once irrespective of the value that would have been uncovered if he had kept it his own. Formulas as of measurement declared alio intuitu may be misleading if wrested from their setting and applied to new conditions. See, e.g., *Standard Oil Co. v. Southern P. Co.*, 268 U.S. 146, 155, 69 L.Ed. 890, 894, 45 S. Ct. 465.
>
> The market test failing, there must be reference to the *values inherent in the thing itself*, whether for use or for exchange. *Industrial & G. Trust v. Tod*, 180 N.Y. 215, 73 N.E. 7, supra. These will not be known by first imagining a forced sale, and then accepting as a measure its probable results. (emphasis added).

Similarly in *Olsson v. United States*, 25 F. Supp. 495, 499 (Ct. Cl. 1938). The United States Court of Claims, predecessor of the Claims Court, in making a valuation of a patent taken by the Government stated:

> Moreover, the record fails to show that plaintiff was able, financially or otherwise, to design and manufacture, or have designed and manufactured, guns embodying his invention which he could have sold to the United States for any determinable profit. He had no existing patent monopoly in any country, except the United States. His patent was not one of general commercial value. The value to the plaintiff of his invention, therefore, resided chiefly in the possibility of its use by the United States in combination with a complete cannon. In these circumstances the value of plaintiff's property right which was appropriated by the United States, and therefore the reasonable and entire compensation to which he was entitled for the use of his invention, must be an amount which the United States ought to have paid him, or would probably have been willing to pay, for a license to use his invention by reason of its utility and the several advantages occurring to the United States by reason of its embodiment in the guns in question.

The Claims Court, despite its previous finding that the Government realized "important savings" in using de Graffenried's invention (Liab. Op. 42a), found during the accounting phase of the law suit as follows:

> Next comes the task of setting the appropriate compensation, i.e., establishing and applying the reasonable royalty. The *best indication* of the royalty that would have resulted from the hypothetical negotiation is plaintiff's 1963 letter to Westinghouse in

> which he offered a license with considerable exclusivity for $50,000 plus a royalty of $2,000.00 per system. (emphasis added)

(Accounting Op. 103a).

It is submitted that the evidence of "important savings", that were realized by the Watervliet Arsenal in using de Graffenried's invention in its valuation of the patent, is a "book of wisdom the courts may not neglect." *Sinclair, supra*, at 698.

Counsel for petitioner has found no court that looked to an internal memorandum two years prior to the date of taking (the date the patent issued) as the best evidence to be used for determining the value of an undeveloped patent on the date of taking. But counsel for petitioner did review a decision of this Court in *United States v. The Berdan Firearms Mfg. Co.*, 156 U.S. 552, 570, 39 L. Ed. 530, 15 S. Ct. 420 (1895) where this Court in considering a patent taking by the Government stated as follows:

> It is further insisted that no other mode of determining the compensation was ever agreed upon between the parties; that the whole history of the transactions between them indicate that that must have been the mode contemplated by each; that in the nature of things, and in accordance with the ordinary rules which control matters of this kind, the price should vary with the number or quantity, and that until the Government had ceased using the device, or at least until the patent had expired, there could be no satisfactory determination of what was a reasonable price for its use.

> It is a sufficient reply that the proceedings before the Hancock Board were abortive and resulted in nothing. The proposition made by the petitioner was never accepted, and the Government never bought any gun made from it or manufactured any like that recommended by the Hancock Board. The proposition contemplated no rights other than the petitioner then had. It did not in terms, or by implication, extend to patents that it might thereafter acquire, and cannot be construed as underlying any action by the Government commenced three years thereafter with reference to a different subject-matter. Because the petitioner in 1866, offered the Government certain patent rights at specified prices, it does not follow that those prices were to control in respect to other patent rights not then in existence, and which were subsequently tendered by it. If the prices were not to control, there is no reason for insisting that the other terms of the original proposition entered into the later transaction. *When the negotiations of 1886 failed they failed for all purposes*, and in the absence of some specific evidence indicating an intent to carry forward the terms of the proposition then made into the new arrangement of 1869, the conditions of this new contract must be determined by the circumstances which attended it. (emphasis added).

It is submitted that the internal memorandum written by Mr. de Graffenried to his brother discussing terms of a proposal to the Westinghouse Corporation, which proposal was never accepted by the Westinghouse Corporation and no runout controllers were ever

built or sold to Westinghouse Corporation pursuant to this proposal, *failed for all purposes*, including, in this instance, the use of this memorandum *as the best indication* of the value of de Graffenried's invention when it issued as a patent two years later.

CONCLUSION

This Petition for Certiorari seeks review under Rule 10, 1(c), Rules of the Supreme Court, that the United States Court of Appeals for the Federal Circuit has decided an important question of law which has not been but should be settled by this Court, and that the United States Court of Appeals for the Federal Circuit has decided a federal question in a way that conflicts with the principles enunciated in the *Sinclair* case, *supra*, for determining the value of a patent, which case is applicable to an eminent domain taking of a patent by the Government.

It is respectfully requested that this Petition for Certiorari be granted.

Respectfully submitted,

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APPENDIX A — UNITED STATES COURT OF APPEALS NOTICE OF ENTRY OF JUDGMENT WITHOUT OPINION

UNITED STATES COURT OF APPEALS
FOR THE FEDERAL CIRCUIT

NOTICE OF ENTRY OF
JUDGMENT WITHOUT OPINION

JUDGMENT ENTERED: DEC 17 1992

The judgment of the court in your case was entered today pursuant to Rule36. This Court affirmed the judgment or decision that was appealed. None of the relief sought in the appeal was granted. No opinion accompanied the judgment. The mandate will be issued in due course.

Costs may be recoverable from the appellant or petitioner in favor of the appellee or respondent under Rule 39. A party entitled to costs is provided with a bill-of-costs form and an instruction sheet with this notice.

The parties are encouraged to stipulate to the costs. A bill of costs will be presumed correct in the absence of a timely filed objection.

Costs when taxed are payable to the party awarded its costs. If costs are awarded to the government, they should be paid to the Treasurer of the United States. Payment should be made to counsel for the party awarded costs or, if the party is not represented by counsel, to the party pro se. Costs should be paid promptly.

Exhibits and visual aids shall be promptly retrieved by the party that lodged them with this court.

Appendix A

FRANCIS X. GINDHART
Clerk

DE GRAFFENRIED V US, 92-5117
(CML - 541-80 C)

APPENDIX B — UNITED STATES COURT OF APPEALS JUDGMENT

UNITED STATES COURT OF APPEALS
FOR THE FEDERAL CIRCUIT

92-5117, -5121

ALBERT L. DE GRAFFENREID,

Plaintiff-Appellant,

v.

THE UNITED STATES,

Defendant/Cross-Appellant.

JUDGMENT

FILED DEC 17 1992

ON APPEAL from the United States Court of Federal Claims in CASE NO(S). 541-80 C.

This CAUSE having been considered, it is ORDERED AND ADJUDGED: AFFIRMED. *See* Fed. Cir. R. 36.

Per Curiam (NEWMAN and SCHALL, *Circuit Judges*, and PLUNKETT, *District Judge*.*

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* Paul E. Plunkett, District Judge, United States District Court for the Northern District of Illinois, sitting by designation.

Appendix B

ENTERED BY ORDER OF THE COURT

DATED DEC 17 1992

s/ Francis X. Gindhart
Francis X. Gindhart, Clerk

APPENDIX C — UNITED STATES CLAIMS COURT JUDGMENT

IN THE UNITED STATES CLAIMS COURT

No. 541-80 C

ALBERT L. DE GRAFFENRIED

v.

THE UNITED STATES

JUDGMENT

FILED MAR 10 1992

Pursuant to the order of March 9, 1992,

IT IS ORDERED AND ADJUDGED this date, pursuant to Rule 58, that plaintiff recover of and from the United States the sum of $542,000.33, plus $65.91 for each day after March 2, 1992, until the date of payment of this judgment. No costs.

David A. Lampen
Clerk of Court
By: [illegible]
Depu.y Clerk

March 10, 1992

NOTE: As to appeal, 60 days from this date, see RUSCC 72, re number of copies and listing of *all plaintiffs*. Filing fee is $105.00.

APPENDIX D — UNITED STATES CLAIMS COURT LIABILITY OPINION

IN THE UNITED STATES CLAIMS COURT

No. 541-80C

(Filed: May 18, 1990)

ALBERT L. DE GRAFFENRIED,

Plaintiff,

v.

THE UNITED STATES,

Defendant.

Patents; patent validity; unauthorized use of patent under 28 U.S.C. § 1498; scope of prior art; qualification as prior art printed publication under 35 U.S.C. § 102; availability of disclosure in patent issued to co-inventors as prior art against patent application by one of the co-inventors; utility; infringement; literal infringement of claim that uses "means plus function" language; equivalents under 35 U.S.C. § 112; doctrine of equivalence; laches.

Richard C. Conover, Bozeman, Montana, for plaintiff.

Chun-I Chiang, with whom were *Assistant Attorney General Stuart M. Gerson* and *Vito J. DiPietro,* Director, Washington, D.C., for defendant.

Appendix D

OPINION

ANDEWELT, Judge.

In this patent action filed pursuant to 28 U.S.C. § 1498, plaintiff, Albert L. de Graffenried, seeks compensation from the United States for the unauthorized use of a device allegedly covered by Claims 1, 2, 5, and 6 of United States Patent No. 3,217,568 (the controller patent). The device in issue is a control system used by the United States Army for the control of "runout" during the manufacture of large cannons (gun barrels) at the Watervliet Arsenal in Watervliet, New York (the Arsenal). Defendant contends that it is not liable under 28 U.S.C. § 1498(a) because (1) the patent claims in issue are invalid, (2) the patent claims do not cover the runout control system used by the Arsenal (*i.e.*, the Arsenal device does not infringe the patent claims), and (3) plaintiff's cause of action is barred under the doctrine laches.

Based on the record produced at trial, the court finds for plaintiff on each issue. Defendant has not established either that the claims are invalid or that this action is barred by the doctrine of laches, and plaintiff has established that the claims cover the accused Arsenal device.

I. Background – The Manufacture of Gun Barrels

Cannons are longstanding weapons of war. The Arsenal commenced cannon manufacture for the United States Armed Forces in the 1800s.

The modern-day manufacture of a cannon commences with the production of a cylindrical tube "forging," which is the approximate length of the finished gun barrel and has a rough cored

hole extending its entire axial length.[1] A precisely dimensioned hole is then bored into the forging, *i.e.*, the rough cored hole is enlarged to a hole of desired diameter. Unlike conventional drilling, where a hole is formed by inserting a rotating drill bit into a stationary work piece, in cannon manufacture the work piece (*i.e.*, the forging) is rotated with respect to the cutting tool. The forging is positioned on a lathe and rotated. A boring bar with a cutting or boring head is then advanced into the forging along the forging's axis of rotation. As the cutting head advances into the rotating forging, it cuts away material along the sides of the rough cored hole. This process is referred to as deep boring or reaming.

The quality of the resulting gun barrel depends upon numerous factors, including the position of the final bored hole. To achieve an optimal result, it is important that the center of the bored hole be close to the center of the forging, *i.e.*, that the center of the hole be near the center of the forging throughout its entire axial length. Achieving this result with consistency, however, has proven difficult. A problem long encountered is that of "runout," where the advancing cutting head moves off the axis of rotation of the forging. Runout can be caused by several factors such as runout of the previously forged hole, variation in the hardness of the forging material, dullness of one or more of the cutters in the cutting head, or improper operation by the lathe operator.

Over the years, a number of technologies have been used to reduce runout in the deep boring of gun barrels. One technology, used as early as the 1800s, is known as the "conventional pack

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1. Depending upon the ultimate dimension of the finished barrel, the length of the forging can range from 10 to 50 feet. In addition, the outer diameter of the forging can vary from 9.2 to 13.5 inches and the diameter of the rough cored hole can vary from 3 to 5 inches.

reamer." The conventional pack reamer used a cylindrical boring head with two cutters which were attached to a boring bar. Mounted on the boring bar behind the cutters was a relatively long wood or, more recently, neoprene pack section. The pack constituted a substantial part of the boring head's circumferential surface and thus provided a tight fit between the boring head and the just-bored hole. By providing a tight running fit and by adding stiffness to the boring bar, the pack reduced any wobbling of the cutting head and, as a result, reduced runout. But while the conventional pack reamer lessened the problem of runout, it did not totally eliminate it. For example, as the cutting head moved down the forging, the packing material became worn and the fit became less tight.

A second technology, used in the late 1950s and early 1960s, is known as the "rapid bore reamer." Like the conventional pack reamer, the rapid bore reamer utilized a cutting head mounted on a boring bar, but instead of using solid packing to provide tightness and stiffness, this device used a fluid. The forging was sealed at one end and a fluid (*e.g.*, oil) was forced under pressure between the cutting head and the just-bored hole. This pressurized fluid served both to cool and stabilize the cutting head during the reaming process. The rapid bore reamer substantially reduced the time necessary to make a gun barrel but it did not solve the problem of runout.

Both the conventional pack reamer and the rapid bore reamer were "blind" operations in that their cutting heads were inside the forging. This prevented the lathe operator from seeing directly whether runout had occurred. When employing these technologies, lathe operators were sometimes able to detect runout by (1) watching to see if the boring bar wobbled, (2) viewing the boring head from one end of the forging to detect movement off

center, or (3) examining the shape of the metal chips removed from the forging ("reading the chips").[2] If runout was detected, the boring head had to be removed and the location and magnitude of runout could be determined by using a mechanical "telltale device." None of these detection methods, however, permitted an accurate quantitative measurement of the amount of runout during deep boring operations and none permitted correction of runout without removing the boring head.

II. Efforts at the Watervliet Arsenal to Prevent Runout

In early 1957, at the request of Arsenal employees, William A. Folsom, an associate of Flight Command Associates (FCA), a small company of which plaintiff was a principal, visited the Arsenal and was briefed on the problem of runout in the manufacture of gun barrels. On March 8, 1957, Folsom and plaintiff met with representatives of the Arsenal to discuss whether runout could be measured during deep boring operations. At that meeting, Folsom and plaintiff received a chart listing the acceptable runout limits at different points along the axial length of the forging.

Folsom subsequently concluded that runout could be detected by mounting a device known as an accelerometer adjacent to the cutting head. An accelerometer detects acceleration. When there is no runout (*i.e.*, the center of the boring head coincides with the axis

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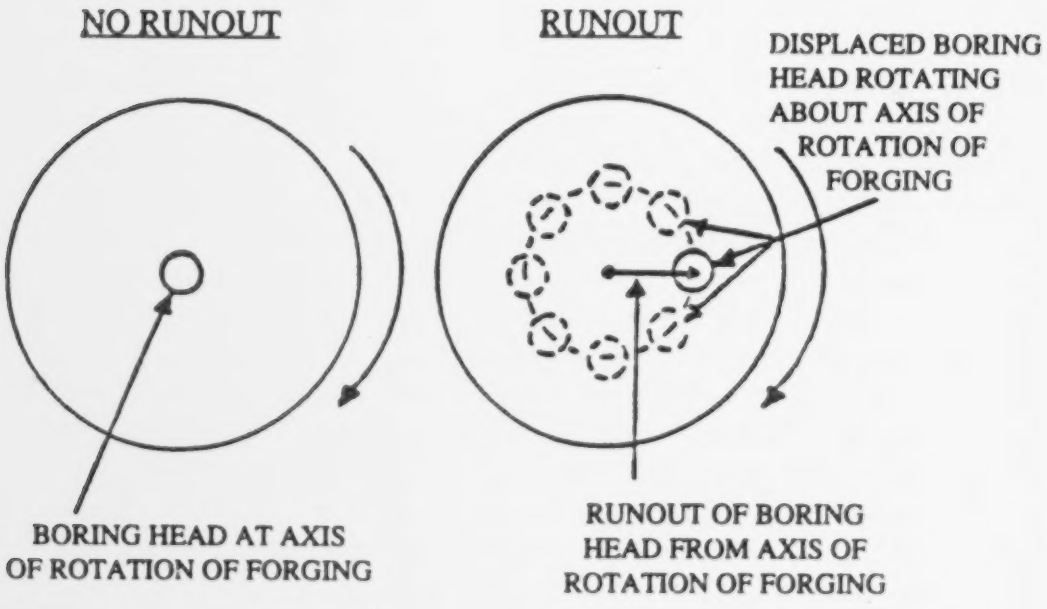
2. When the boring head operates along the axis of the forging, the chips of metal removed are approximately uniform in shape. However, when runout occurs, and the boring head no longer operates along the axis of the forging, the chips of metal removed vary in shape. Upon noticing such variances, a skilled operator would know runout had occurred.

of rotation of the forging), the boring head would remain steady and the attached accelerometer would remain still. However, as the following cross-sectional diagram shows, when runout occurs (*i.e.*, the center of the boring head departs from the axis of rotation of the forging), the boring head and the attached accelerometer would orbit about the axis of rotation of the forging, *i.e.*, the rotation of the forging would result in the rotation of the boring head.[3]



3. For ease of illustration, the rough cored hole is not shown, the comparative size of the boring tool is reduced, and the amount of runout is exaggerated. The maximum runout allowable by the Arsenal was on the scale of a fraction of an inch.

As a result of this movement of the boring head, the accelerometer would emit a signal. The greater the amount of runout, the greater the amplitude of acceleration and the greater the amplitude of the signal.

On or about September 9, 1957, plaintiff prepared and forwarded to Arsenal employees an unsolicited "proposal for a study and development project" which proposed the development of a runout indicator.[4] In 1958, the Arsenal awarded FCA a contract covering the "[d]esign, manufacture, and test[ing] of a device to indicate tool runout during deep boring operations on 90mm gun barrels and to give an alarm when the runout exceeds the maximum value. . . ."

From 1958 to 1960, plaintiff and Folsom worked on developing a runout indicator device for use in deep boring operations at the Arsenal. In addition, plaintiff began thinking on his own about how runout could actually be controlled during deep boring operations. Plaintiff concluded that the condition of runout could be abstractly represented by a vector, *i.e.*, by an arrow extending from the center of rotation of the forging to the center of the bored hole. (A vector is an abstract concept commonly thought of as an arrow indicating direction and having a length

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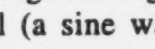
4. Runout correction was also mentioned in the proposal under the heading "A Subsequent Problem." Plaintiff stated:

> A few brief comments on runout correction are offered here. Based on an estimate by F.C.A. engineers of 80% probability of success in building such a run-out detector/indicator, one can justify a "first look" at the problem of run-out correction.

corresponding to a scaler quantity.) During runout, the vector would rotate with the boring head as it orbited the axis of rotation of the forging. Plaintiff concluded that the signal given off by the accelerometer in Folsom's design would be representative of the horizontal projection of the vector onto the horizontal axis of the forging. As a result, plaintiff concluded, the output of the accelerometer would provide information not only as to the magnitude of runout, as Folsom had discovered, but also as to the direction of runout, *i.e.*, the location of the bored hole with respect to the center of rotation of the forging. The signal output of the accelerometer would be sinusoidal (a sine wave  with a maximum value when the boring head is on the horizontal axis of the forging and a zero value when the boring head is on the vertical axis. The phase of the sinusoidal signal, *i.e.*, where the peaks and valleys occur, would indicate the direction of runout. Plaintiff concluded that since the accelerometer signal contains information both as to the magnitude and the location of runout, the signal could be used to control runout.

In 1960, FCA delivered to the Arsenal an indicator device, an operating manual, and a final report entitled "An Electronic Tool-Run-out Indicator for Use in Deep Boring Operations (90mm gun barrels)." The final report suggested that it might be possible to use the accelerometer signal not only to detect but also to control runout. On July 20, 1960, plaintiff and Folsom filed a patent application, as co-inventors, covering a method for detecting runout using an accelerometer. This application ultimately was issued as United States Patent No. 3,020,786 (the indicator patent).

As a result of the success of the runout indicator developed by FCA, in early 1962, Arsenal personnel began to explore development of a runout controller. The procurement procedure

was conducted in a two-step competitive process. First, interested parties were asked to submit technical proposals; second, for those technical proposals deemed qualified, the submitted parties were asked for competitive bids. The "Request for Technical Proposals," sent out on June 6, 1962, did not specify use of the runout indicating technology developed by FCA because FCA's work was considered developmental and not necessarily the best approach to controlling runout. The project leader of the effort to develop a controller was Arsenal employee William Wondisford.

In response to the Arsenal's "Request for Technical Proposals," FCA proposed a runout controllers system in which an accelerometer would produce a runout error signal which would activate a "force generating means" (either electromagnetic or hydraulic) to move the boring head back to its desired center position of the forging. Prior to submission of FCA's technical proposal, on May 23, 1962, plaintiff filed a patent application for a "Device for Controlling Deep Boring Operations in a Rotating Object" which ultimately was issued as the controller patent, in issue in this action.

Bergen Research Engineering Corp. (Bergen) submitted a competing technical proposal which employed a radically different technological approach for controlling runout. Bergen proposed extending a taut wire along the axis of the forging through the already existing rough cored hole. During runout, when the cutting head would move off the taut wire, hydraulic pistons would guide the cutting head back to its desired center position.

The Arsenal found both FCA's and Bergen's proposals technically acceptable and awarded the contract to Bergen which had submitted a substantially lower bid – $28,086 versus FCA's bid

of $46,000. Bergen engineers worked with Arsenal personnel on the development of the taut wire technology but, ultimately, they decided the technology would not work. Instead, they decided to use accelerometers to detect runout and direct the movement of hydraulic pistons, as was originally proposed by FCA. On July 2, 1965, the Arsenal accepted a controller unit developed by Bergen and paid the amount remaining due under the contract.

The Bergen controller device never was used in the production of gun barrels but the Arsenal continued development and manufacture of a runout controller. The project was ultimately successful. In January 1967, a bore guidance device was first used at the Arsenal in deep boring operations, and in December 1968, a runout controller was used in the production of gun barrels. By March 1980, 19,585 gun barrels had been manufactured at the Arsenal using lathes adapted with runout controllers.

III. The Indicator and Controller Patents

A. The Indicator Patent

The indicator patent was issued to plaintiff and Folsom as co-inventors on February 13, 1962. The patent, entitled "Electronic Tool Run-Out Indicator for Use in Deep Boring Operations," discloses a device for sensing and indicating the presence of runout during the manufacture of gun barrels. The device contains a boring tool which has a boring head with cutters attached. Hingedly mounted along the center line of the boring head is an accelerometer. When runout occurs, the boring head and attached accelerometer rotate about the center of rotation of the forging. The rotation causes the accelerometer to emit a signal. When the displacement of the boring tool from the center line of rotation exceeds a predetermined value, an alarm is sounded.

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The indicator patent discloses three types of accelerometers: a seismic pendulum, a capacitive displacement accelerometer, and an "electrolytic accelerometer." The indicator patent does not specifically indicate that the signal emitted by the accelerometer can be used to control runout. It does, however, in columns 3 and 4 and figure 2, describe plaintiff's vector theory of runout.

B. The Controller Patent – Description of the Invention in the Specification

The controller patent, issued on November 16, 1965, discloses a device for controlling runout during deep boring operations. Plaintiff is the sole inventor and sole owner of the patent. The patent specification commences with a discussion of the indicator patent. The specification states, in effect, that the indicator patent discloses a device for sensing and measuring runout during deep boring operations through a runout signal, and that the contribution of plaintiff in the controller patent is to use that runout signal to control runout by restoring the boring head to the axis of rotation of the forging.

The controller patent, like the indicator patent, describes a device containing a boring tool which has a boring head with cutters and an accelerometer hingedly attached. The only accelerometer specifically described in the controller patent is a seismic pendulum. When runout occurs, the boring head begins to orbit about the axis of rotation of the forging and the seismic pendulum begins to swing. The angle at which the pendulum swings is converted into a proportional voltage by a rotary variable differential transformer. The proportional voltage modulates a carrier wave which is subsequently manipulated by electrical circuitry. The resulting sinusoidal signal can be extrapolated to represent the magnitude and direction of runout — the amplitude

of the sinusoidal signal is directly proportional to the magnitude of runout and the phase of the sinusoidal signal indicates the direction of the runout, *i.e.*, the location of the boring head with respect to the center of rotation of the forging. The sinusoidal signal is then used to create a restoring force which returns the boring head to the longitudinal axis of rotation of the forging. The specification indicates that the restoring force can be hydraulic, Pneumatic, or electromagnetic.

The controller patent discloses two possible modes of operation — open loop and closed loop. The open loop mode involves the participation of the lathe operator in the correction of runout, while the closed loop mode is fully automatic. In the open loop mode, the lathe operator "reads" the sinusoidal signal to note the position and magnitude of the runout and then performs an adjustment to produce the desired restoring force. In the closed loop mode, an error signal is used to trigger automatically the appropriate restoring force.

IV. The Controller Patent – The Claims in Issue

Claims 1, 2, 5, and 6 of the controller patent each covers a boring device. Claims 1 and 6 are independent and Claims 2 and 5 are dependent upon Claim 1. The claims are reproduced below.

> 1. A boring device for deep boring an object rotating about an axis, comprising:
>
> > [1] a boring tool adapted to be advanced substantially parallel with said axis and including a cutting head for cutting the interior of said rotating object;
> > [2] means for advancing said boring tool;

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[3] means adapted to sense the direction and magnitude of the run-out from said axis to the center of a bored hole made by said cutting head, said sensing means being adapted to generate a run-out signal indicative of said magnitude and direction, whereby the position of the boring tool relative to said axis may be determined;

[4] force generating means adapted to provide a force acting on the cutting head to cause radial displacement of said cutting head responsive to said run-out signal whereby said run-out may be controlled in direction and magnitude.

2. The apparatus of claim 1 wherein said force generating means are hydraulic means.

5. A device as in claim 1 wherein said means to generate a run-out signal comprise movable means mounted on said boring tool for sensing movement of the boring tool, whereby upon said boring tool being subjected to run-out, the center of said boring tool orbits about the said center line and imparts oscillatory motion to said movable means, and electrical means responsive to the movement of said movable means for indicating the existence and degree of run-out, wherein said movable means includes a pendulum member hingedly mounted on the center line of said boring tool and vibrating in response to the orbital motion of said boring tool, and wherein said electrical means include a rotary variable differential transformer, wherein said transformer is sinusoidally modulated by said pendulum swings.

6. A device for controlling the deep boring of an object

rotating about a predetermined axis and in engagement with a cutting head comprising:

> a boring tool adapted to be advanced approximately in parallel with said center line and including said cutting head; means for axially advancing said boring tool along the axis; means mounted on said boring tool adapted to sensing the direction and magnitude of the run-out from said axis to the center of the bored hole made by said cutting head, said sensing means being adapted to generate a run-out signal indicative of said magnitude and direction, whereby the position of the boring tool relative to the axis may be determined; electromagnetic means disposed proximate to said boring tool, said electromagnetic means being adapted to generate a force and thereby radially displace said boring head and said rotating object relative to each other upon energization of said electromagnetic means; and means responsive to said run-out signal to selectively impart such energization whereby said displacement of said cutting head and said rotating object relative to each other may be controlled direction and magnitude.

Defendant contests the validity of all claims in issue. Defendant alleges that Claims 1, 2, and 5 are invalid for failing to meet the statutory requirement of nonobviousness (35 U.S.C. § 103) and that Claim 6 is invalid because the invention there described is inoperative (35 U.S.C. § 101).

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V. Claims 1, 2, and 5 are Not Invalid Based on Obviousness

A. Legal Standards

In *Casler v. United States*, 15 Cl. Ct. 717, 722-23, 9 USPQ2d 1753, 1757 (1988), this court recently reviewed the legal standards applicable when assessing whether a claim satisfies the statutory requirement of nonobviousness. The court stated:

> Pursuant to 35 U.S.C. §§ 103 and 282, the claims in a patent are invalid if "the differences between the subject matter [of the claims] and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to one of ordinary skill in the art to which the subject matter pertains." The claims in an issued patent are presumed valid, 35 U.S.C. § 282, and the party challenging validity has the burden of proving invalidity by clear and convincing evidence. *Atlas Powder Co. v. E.I. Du Pont de Nemours & Co.*, 750 F.2d 1569, 1573, 224 USPQ 409, 411 (Fed. Cir. 1984).
>
> A determination on the issue of nonobviousness entails a conclusion of law. *Environmental Designs, Ltd. v. Union Oil Co. of California*, 713 F.2d 693, 695, 218 USPQ 865, 867 (Fed. Cir. 1983), *cert. denied*, 464 U.S. 1043, 104 S.Ct. 709, 79 L.E.2d (1984). However, that legal conclusion must be based upon a series of factual determinations. The court must evaluate (1) the scope of content of

> the prior art, (2) the differences between the prior art and the claimed invention, (3) the level of ordinary skill in the pertinent art, and (4) evidence directed at so-called secondary considerations, which may serve as indicia of nonobviousness. *Graham v. John Deere Co.*, 383 U.S. 1, 17, 86 S.Ct. 684, 693, 15 L.Ed.2d 545, 148 USPQ 459, 467 (1966); *Atlas Powder*, 750 F.2d at 1574, 224 USPQ at 412; *Environmental Designs*, 713 F.2d at 695, 218 USPQ at 867.

B. Scope and Content of the Prior Art

The sole reference cited by the Patent Office prior to issuing the controller patent was the previously issued indicator patent. In contesting the validity of the controller patent, defendant relies upon the indicator patent plus four other written references: United States Patent No. 2,475,245 issued on July 5, 1949, to E.W. Leaver, et al. (the Leaver patent); United States Patent No. 3,069,608 issued on December 18, 1962, to J.W. Forrester, et al. (the Forrester patent); a text published in 1958 and authored by J. Bower and P. Schultheiss entitled "Introduction to the Design of Servomechanisms" (the Bower text); and a report issued in April 1957 by H.J. Haag entitled "Significant Achievements in the Reaming of gun Barrels" (the Haag report). In addition, defendant relies upon the indicator device delivered by FCA to the Arsenal in March 1960. Plaintiff disputes defendant's use of each of the five written references and the indicator device as prior art.

1. Only Parts of the Indicator Patent are Within the Scope of the Prior Art

Defendant contends that the indicator patent is properly

classified as prior art pursuant to 35 U.S.C. § 102(e) and that the indicator patent combined with the indicator device delivered by FCA to the Arsenal are prior art under 35 U.S.C. § 102(g). Plaintiff agrees that parts of the specification in the indicator patent are prior art but contends that other parts are not.

35 U.S.C. § 102 states, in pertinent part:

> A person shall be entitled to a patent unless—
>
> * * *
>
> (e) the invention was described in a patent granted on an application for patent by *another* filed in the United States before the invention thereof by the applicant for patent . . .
>
> * * *
>
> (g) before the applicant's invention thereof the invention was made in this country by *another* who had not abandoned, suppressed, or concealed it.

(Emphasis added.) The dispute herein involves the extent to which the indicator patent is by "another" and, hence, prior art against the controller patent.

Defendant contends that the indicator patent is by "another" vis-a-vis the controller patent because the indicator patent was issued jointly to plaintiff and Folsom while the controller patent was issued to plaintiff alone. Defendant is correct that the combination of plaintiff and Folsom is a different inventive entity

than plaintiff alone, and that joint work by plaintiff and Folsom can be prior art against plaintiff's controller patent. The pertinent law in this regard has been summarized as follows:

> In determining whether prior work is in fact by "another," the theory of the inventorship entity must be applied. The sole work of one person is usable against the joint work of that person with another. Similarly, the joint work of two or more persons is usable against the sole work of both and against the joint work of any other inventorship entity.

1 D. Chisum, *Patents*, § 3.08[2] at 3-152 (1990) (footnote omitted); *see also, In re Ward and Switzer*, 236 F.2d 428, 431-32, 111 USPQ 101, 104 (CCPA 1956).

But as explained in *In Re DeBaun*, 687 F.2d 459, 214 USPQ 933 (CCPA 1982), simply because a patent is issued to joint inventors does not mean that everything disclosed in that patent is necessarily joint work which would constitute prior art against a subsequent patent application by one of the two joint inventors. In *DeBaun*, a patent covering an air sampling system was issued to two inventors, Kenneth W. DeBaun and Robert W. Noll. DeBaun subsequently filed a patent application on his own which contained claims covering a specific cross section of an air duct disclosed but not claimed in the patent previously issued to DeBaun and Noll. DeBaun filed an affidavit to the effect that he was the inventor of the cross section and that the cross section had been included in the previous joint patent on the advice of counsel. The Court of Customs and Patent Appeals found this affidavit sufficient to prevent the prior disclosure in the joint patent from being used as prior art against DeBaun's individual discovery. The court rejected

the argument that all information disclosed in a joint patent was necessarily the product of a joint invention. The court stated: "The [joint] patent is silent with respect to who invented the [cross] section itself, and we do not presume that it is the invention of DeBaun and Noll jointly or of either of them." *Id.* at 463, 214 USPQ at 936. The *DeBaun* court explained that in such a case "the proper subject of inquiry was . . . what the *evidence* showed as [to] *who* invented the [cross section disclosed in the patent]." *Id.* at 462, 214 USPQ at 935 (emphasis added).

Thus, *DeBaun* requires a factual determination as to which parts of the indicator patent were the product of joint work and, hence, would constitute prior art, and as to which parts were the product of plaintiff's independent work and, hence, would not constitute prior art.

The evidence on this issue, including the trial testimony of plaintiff and Folsom, is entirely consistent. As explained above, Folsom originated the idea that attaching an accelerometer to a boring head would produce a sinusoidal signal indicative of the magnitude of runout. However, Folsom did not consider using that signal to control runout. Without Folsom's participation, plaintiff developed his vector approach to runout and concluded that the phase of the accelerometer's sinusoidal signal would be indicative of the direction of runout. Plaintiff drafted the application for the indicator patent on his own. He did not specifically mention the use of an accelerometer signal to control runout but he did describe his vector theory which arguably suggests the use of an accelerometer signal to control runout. This latter description is plaintiff's contribution, not Folsom's, and therefore cannot, under *DeBaun*, be used as prior art against the controller patent pursuant to 35 U.S.C. § § 102(e) and (g).

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2. The Indicator Device is Within the Scope of the Prior Art

The indicator device, in pertinent part, is apparently a physical embodiment of the device described in the indicator patent. It does not contain any structures that plaintiff alleges were the product of plaintiff's work alone. Hence, the indicator device is by "another" and therefore within the scope of the prior art.

3. The Leaver and Forrester Patents are Within the Scope of the Prior Art

Plaintiff contends that the Leaver and Forrester patents are not within the scope of the prior art herein because, unlike the controller patent, they do not involve deep boring operations. The controller patent describes a machine tool operation involving a lathe in which a runout error signal is changed into a negative error signal which is then used to move the boring head in the opposite direction of runout. As described below in more detail, both the Leaver and Forrester patents similarly involve machine tool operations employing negative feedback to assure that the final product is cut to desired specifications. The Leaver patent involves a lathe and the Forrester patent, while specifically disclosing a milling machine, indicates that it can be used in other operations. While neither the Leaver nor Forrester patent specifically discloses deep boring operations and both differ in other ways from the invention described in the controller patent, both are "reasonably pertinent to the particular problem" with which plaintiff was faced when seeking a solution to runout. Therefore, under *In Re Wood and Eversole*, 599 F.2d 1032, 1036, 202 USPQ 171, 174 (CCPA 1979),[5]

5. Plaintiff also argues that the Leaver and Forrester patents cannot be part of a combination reference because neither patent suggests that it could be used as the force generating means stated in Claim 1 of the controller patent. However, the (Cont'd)

the Leaver and Forrester patents are "analogous art" and within the scope of the prior art for 35 U.S.C. § 103 consideration. [6]

4. The Bower Text is Within the Scope of the Prior Art

As summarized below, the Bower text defines the term "servomechanism" and teaches the use of servomechanisms for correction of errors. Plaintiff contends that the Bower text is not prior art because it does not discuss deep boring operations and lacks an "enabling disclosure."

The absence of a discussion of deep boring operations is not fatal here because the Bower text qualifies as "analogous" art. As

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(Cont'd)
suggestion of combination may be implicit from the teachings of all the references viewed together. *Milliken Research Corp. v. Dan River, Inc.*, 739 F.2d 587, 602, 222 USPQ 571, 583 (Fed. Cir. 1984). Therefore, assessing whether the references suggest a combination is a question of obviousness, which is discussed below.

6. In *Wood and Eversole*, the Court of Customs and Patent Appeals explained:

> [W]e attempt to more closely approximate the reality of the circumstances surrounding the making of an invention by only presuming knowledge by the inventor of prior art in the field of his endeavor and in analogous arts.
>
> The determination that a reference is from a nonanalogous art is therefore two-fold. First, we decide if the reference is within the field of the inventor's endeavor. If it is not, we proceed to determine whether the reference is reasonably pertinent to the particular problem with which the inventor was involved.

evidence in the pertinent disclosures of the Forrester and Leaver patents discussing the use of negative feedback mechanisms, it would be expected that one reasonably skilled in the pertinent art would be familiar with the principles of the servomechanisms discussed in the Bower text.

Next, plaintiff is correct that the Bower text lacks an enabling disclosure in that it does not disclose sufficient information to enable a person reasonably skilled in the art to devise a controller device without further inspiration or undue experimentation. But while an enabling disclosure may be required when determining whether an invention is anticipated by the prior art under 35 U.S.C. § 102 (*see, e.g., Struthers Scientific & Int'l Corp. v. Rappl & Hoenig*, 453 F.2d 250, 172 USPQ 257 (2d Cir. 1972)), there is no need for an enabling disclosure when assessing pertinent prior art for a Section 103 obviousness analysis. As explained in *Minnesota Mining & Mfg. Co. v. Blume*, 684 F.2d 1166, 1172 n.10, 215 USPQ 585, 590 n.10 (6th Cir. 1982), *cert. denied*, 460 U.S. 1047, 461 U.S. 939 (1983):

> The standard [under 35 U.S.C. § 103] is quite simply whether the prior art, taken as a whole makes obvious the invention under consideration. . . . [T]o argue . . . that the sufficiency of each prior art teaching must be tested under a strict standard requiring an enabling disclosure is to shift the emphasis from obviousness in light of the prior art, taken as a whole, to the sufficiency of each prior art teaching separately considered.

5. The Haag Reference is Not Within the Scope of the Prior Art Because it Does Not Qualify as a Printed Publication Under 35 U.S.C. § 102

The Haag report is an Arsenal document dated April 1957.

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Under the heading "Future Work," the report describes future possible efforts directed at solving the problem of runout in the manufacture of gun barrels. Apparently based on conversations with plaintiff, the report mentions that "[i]nvestigation and development are presently directed towards utilization of an inertial device mounted within the reaming head. Any deviation of this mechanism from its planned location would be electrically transmitted to a control unit which would then take the necessary corrective action."

Defendant contends that the Haag report is a printed publication satisfying all requirements for use as prior art under 35 U.S.C. § 102. In response, plaintiff denies that the Haag report is prior art for a number of reasons, one of which is compelling.[7] Plaintiff is correct that defendant has not satisfied its burden to show that the Haag report was sufficiently accessible to the public to qualify as a printed publication within the scope of Section 102 prior art.[8]

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7. Defendant contends that by waiting until post-trial briefing, subsequent to the presentation of proposed findings of fact, plaintiff waited too long to object to classification of the Haag report as prior art. But plaintiff gave timely warning of his position when prior to trial he insisted that a proposed stipulation be amended to eliminate a concession that the Haag report was a printed publication and prior art.

8. Plaintiff also alleges, for example, that the Haag report is not prior art because it lacks an enabling disclosure. But, as explained above, the absence of an enabling disclosure is not fatal. Plaintiff also contends that the concept mentioned in the Haag report was derived from statements by plaintiff and did not originate with Haag. But, while the evidence supports such a conclusion, this would not bar the use of the Haag report as prior art. Any invention described in a printed publication more than one year prior to the date of a patent application is prior art under Section 102(b), even if the printed publication was authored by the patent applicant.

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The term "printed publications" appears in both Sections 102(a) and (b). Section 102 provides, in pertinent part:

> A person shall be entitled to a patent unless—
>
> > (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for patent, or
> >
> > (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of the application for patent in the United States[.]

"Public accessibility" is the touchstone in determining whether a document qualifies as a printed publication. *In re Hall,* 781 F.2d 897, 899, 228 USPQ 453, 455 (Fed. Cir. 1986). In *Carella v. Starlight Archery & Pro Line Co.*, 804 F.2d 135, 139, 231 USPQ 644, 646-47 (Fed. Cir. 1986), the Court of Appeals for the Federal Circuit, quoting *In re Wyer,* 655 F.2d 221, 227, 210 USPQ 790, 795 (CCPA 1981), described the burden on a party proffering a document as a printed publication, as follows:

> [O]ne who wishes to characterize the information, in whatever form it may be, as a "printed publication"
>
> > * * * should produce sufficient proof of it dissemination or that it has otherwise

> been available and accessible to persons concerned with the art to which the document relates and thus most likely to avail themselves of its contents.

In *In re Hall*, the court reiterated this same approach by stating that "[t]he proponent of the publication bar must show that prior to the critical date the reference was sufficiently accessible . . . to the public interested in the art. . . . *In re Hall*, 781 F.2d at 899, 228 USPQ at 455.

To support its contention that the Haag report was "sufficiently accessible . . . to the public interested in the art," defendant relies upon a declaration by Hazel T. Horton, Chief of the Document Processing Division, Defense Technical Information Center (DTIC), Defense Logistics Agency.[9] Horton explained generally the procedures employed by DTIC and its predecessor, the Armed Services Technical Information Agency (hereinafter both referred to as DTIC), with respect to cataloging and permitting access to the reports in its files. She stated that DTIC received the Haag report on February 20, 1961, and catalogued it the next day by placing the following reference in DTIC's internal index system.

UNCLASSIFIED

AD-221 536 Div. 22. 26 U
(2C Feb 61)
(Unannounced report)

Watervliet Arsenal, N.Y.

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9. The declaration was entered into evidence by stipulation of the parties.

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SIGNIFICANT ACHIEVEMENTS IN THE REAMING OF GUN BARRELS.
by H. J. Haag. Apr 57. 22p. incl. illes. (Technical rept. no. INPRO-129)
Unclassified report

DESCRIPTORS: "Gun barrels. Cutting tools. Manufacturing methods, Machining. "Reamers. Carbide tools. Synthetic rubber.

UNCLASSIFIED

As to the accessibility of unclassified DTIC documents, such as the Haag report, Horton described DTIC's customary practice during the pertinent time frame. First, access to DTIC documents was limited to "registered users," which included "government agencies, current government contractors, grantees of government research grants and their universities or research organizations." Second, once the information was placed in DTIC's internal index system, DTIC accepted inquiries from registered users which sought specified documents or documents indexed by particular key words or descriptors. Searches were conducted exclusively by DTIC staff who then forwarded the requested documents free of charge. In addition, DTIC forwarded to major registered users copies of prepared index cards which matched their bibliographic requests. Third, DTIC furnished material to contractors for government purposes only. Horton stated: "At the time frame of the above mentioned documents, it was the usual and customary practice of [DTIC] to forward to [sic] protection restrictions. However, material furnished to contractors was provided for government purposes only based on the contracts registered with [DTIC]." Horton did not indicate which "protection restrictions" applied to the Haag report. Horton indicated that while it was

indicated that while it was customary to announce and provide a short abstract of newly acquired documents in semimonthly Technical Abstract Bulletins ("TABs"), there is no indication in the records that this was done for the Haag report.

Defendant cites *Boileau v. Diamond*, 209 USPQ 190 (D.D.C. 1980), *aff'd in part and rev'd in part*, 659 F.2d 247, 211 USPQ 489 (D.C. Cir. 1981), to support its contention that this accessibility of the Haag report is sufficient to satisfy the Section 102 requirements for use as prior art. Like the case at bar, *Boileau* involved a document that had been indexed by DTIC. But while the *Boileau* court determined that the document there involved qualified as a printed publication under Section 102(b), the court did not indicate that accessibility from DTIC files by registered users was itself sufficient to demand that conclusion. The *Boileau* court framed the crucial issue as follows: "[T]he question is whether [the report] can be said to be within reach of the interested public. If those portions of the public technically knowledgeable and interested could have obtained access, then the Report qualifies as prior art." *Id.* at 192. In answering yes to this question, the court did not rely primarily upon the restricted availability of the document from DTIC but instead relied upon the actual distribution of the document that had occurred within the relevant scientific community. The court stated:

> It is . . . undisputable that the document was widely distributed and had acquired an unclassified status considerably prior to July, 1973. . . . A broad assortment of government agencies, private corporations and universities were in possession of the Report. There is no evidence that discourse was in any way limited among this knowledgeable and experienced sub-group of the public. A request to the

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> Arsenal from any member of the public would have been honored. Where, as here, the wide, unrestricted distribution was among persons skilled in the art, and any obligation of secrecy was effectively disavowed, the Court concludes that public access to the document must be found sufficient to satisfy the statute.

Id.

The case at bar does not involve similar distribution. There is no evidence in the record of any distribution beyond DTIC; there is no indication that any entity, much less those entities technologically knowledgeable and interested, ever requested or received from DTIC either an actual copy of the Haag report or any information (such as a TAB) indicating that the report existed. Hence, nothing in the record shows that evidence of and access to the Haag report was available other than to registered users through the cumbersome request procedures of DTIC.

The question thus becomes whether access to registered users is itself sufficient, without more, to qualify the Haag report as a printed publication and prior art. In answer, the record simply does not demonstrate that it is. There is no evidence as to the number or specific identity of registered users or the technological knowledge and interests of the individuals who worked for them. There is no evidence as to the particular "protection restrictions" applied to access or use of the Haag report. Indeed, there is no evidence that the two experts defendant presented to testify on the issue of patent validity could have obtained access to the Haag report from DTIC. In sum, there simply is no proof that the Haag report was accessible to any significant number of "those persons interested and knowledgeable" in this technological area.

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The courts have stressed that the question of whether a document constitutes a printed publication turns on a case-by-case evaluation of the facts. *In re Hall*, 781 F.2d at 899, 228 USPQ at 455.[10] Based on the facts in evidence, defendant has not satisfied its burden to qualify the Haag report as a printed publication within the scope of the prior art.

C. Differences Between the Prior Art and the Claimed Invention

1. The Indicator Patent and the Indicator Device

With respect to Claim 1 of the controller patent, the parties agree that the indicator patent discloses the boring tool called for in element 1 and the means for advancing the boring tool called for in element 2. In addition, the parties agree that the indicator patent does not address the control of runout and, hence, does not disclose a force generating means for correcting runout called for in element 4. The parties disagree, however, as to whether the indicator patent discloses the means adapted to sense the direction and magnitude of runout called for in element 3. Clearly, in both the controller and indicator patents the respective accelerometers produce the same type of signal which contains the same information concerning the direction and magnitude of runout. But the indicator patent concerns only detecting and not controlling runout. Therefore, there is no concern in the indicator patent with manipulating the accelerometer signal in such a way as to assure that the sinusoidal signal could be used as an error signal to control

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10. Plaintiff, in effect, faults the Horton declaration for indicating the customary procedures employed but not presenting clear and convincing evidence that the Haag report was actually handled pursuant to those procedures. But the Horton declaration, absent rebuttal evidence, supports a conclusion that the Haag report was handled consistent with ordinary and customary procedures.

runout. In addition, the only discussion in the indicator patent that arguably suggests that the accelerometer signal contains information concerning the direction of runout is the vector theory discussion in columns 3 and 4 of the specification and the corresponding figures. As explained above, that portion of the indicator patent was solely plaintiff's contribution and therefore is not prior art.

With respect to Claims 2 and 6 of the controller patent, since the indicator patent does not disclose any force generating means, it obviously does not describe the specific hydraulic force generating means called for in Claim 2 or the electromagnetic means called for in Claim 6. As to Claim 5 of the controller patent, the indicator patent does disclose the use of the hinged pendulum member and rotary variable differential transformer called for in Claim 5.

As to the indicator device, apparently the device is simply an embodiment of the device described in the indicator patent. The device contains no "force restoring means" as called for in Claim 1 (element 4) of the controller patent, and defendant has not established that its accelerometer signal was manipulated by the electrical circuitry in such a way as to be directly useable as an error signal to control runout.

2. The Leaver Patent

The Leaver patent, entitled "Method and Apparatus for the Automatic Control of Machinery," describes, in general, the recording of movements of a machine tool during performance of a particular job by a skilled operator, and the later use of that recording to perform the same job automatically, *i.e.*, the machine repeats automatically and at optimum speed the recorded movements of the machine parts.

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Defendant relies primarily on the Leaver patent's discussion of the use of an information signal and a prerecorded standard signal to keep a machine tool moving along a desired path. In operation, the machine cutting tool is mounted on a cross slide, the movement of which is controlled by a gear box and motor. A synchro (a type of transformer) sends out a signal indicating the actual position of the machine tool. The synchro signal travels to a phase detector where it is compared with a preprogrammed position signal generated by a demodulator. The phase detector produces a negative signal indicating any difference between the actual and desired position of the cutting tool. That difference signal ultimately directs the cutting tool to move along the cross slide to its desired position. Thus, the motion of the cutting tool is controlled through a feedback system in which two signals are compared and a third signal is created to indicate how far the cutting tool has moved from its desired position. In response to this third signal, a force is generated to move the cutting head back to its desired position.

Hence, the Leaver patent does not specifically address runout during deep boring of a rotating object and does not specifically employ any of the four elements called for in Claim 1 of the controller patent. However, like the controller patent, the Leaver patent employs a negative feedback system in which a cutting tool is moved to a desired position in response to an electrical error signal. But while the controller patent involves only one signal — the accelerometer signal, the Leaver patent produces an error signal by a comparison of two separate signals. In addition, in the Leaver patent, none of the signals is generated by an accelerometer; the signal indicating the cutting head's desired position is preprogrammed; and the signal indicating the cutting head's actual position is produced by an electrical transformer. Hence, while the Leaver patent teaches the use of a negative feedback system, it teaches nothing about using the phase of an accelerometer signal to indicate the radial direction of an error in deep boring operations.

3. The Forrester Patent

The Forrester patent, entitled "Numerical Control Servo-System," also relates to controlling the operation of a machine tool. The patent describes the purpose of the invention as "to provide an improved control system which is especially desireable for machining mathematically definable surfaces without resorting to the expensive practice of first constructing models or templates having better than the required accuracy of the finished work." The control system involves storing information relating to the coordinated movement of a machine in coded form and using electrical means for interpreting the coded information and transmitting it to the moving part of the machine.

In attacking the validity of the controller patent, defendant relies primarily upon Figures 10 and 11 of the Forrester patent. These figures show an apparatus for moving a work piece supported by a table to a desired position. The movement is produced by a feedback signal. Figure 10 is illustrative.

[see Figure 10, next page]

Fig. 10

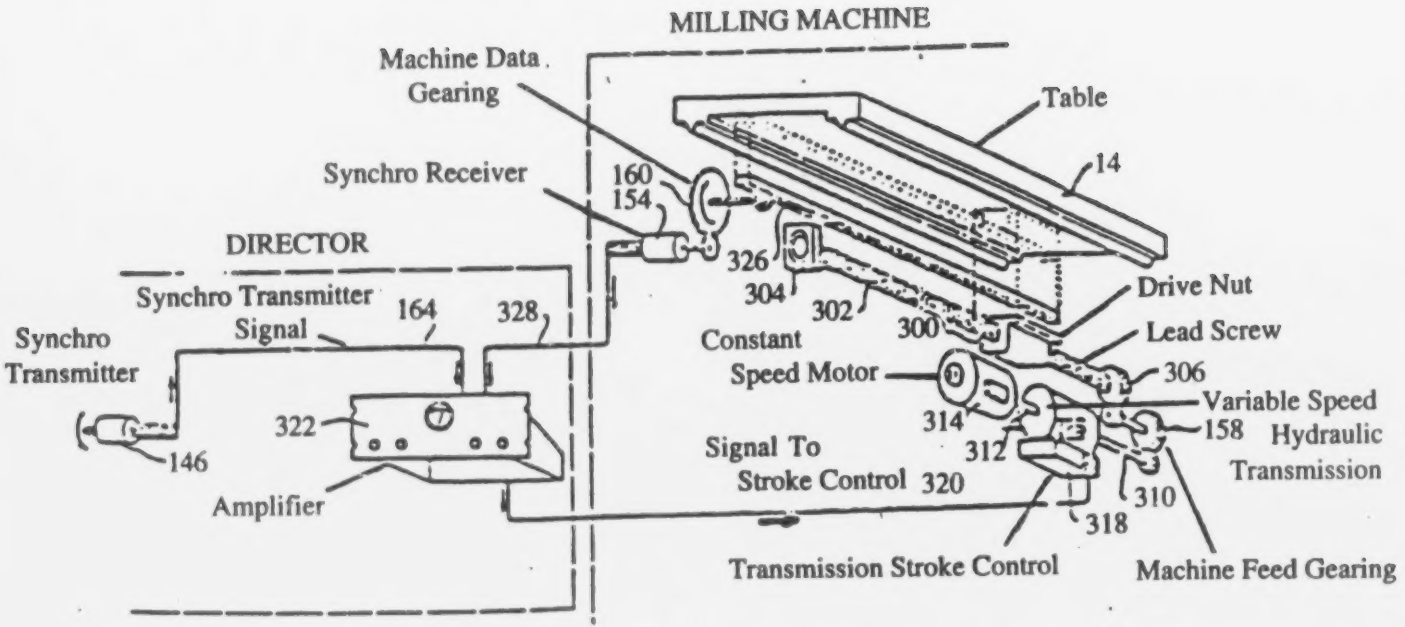
MILLING MACHINE
Machine Data Gearing
Table
14
Synchro Receiver
160
154
DIRECTOR
326
304
302
300
Drive Nut
Lead Screw
Synchro Transmitter Signal
164
328
Synchro Transmitter
Constant Speed Motor
306
Variable Speed Hydraulic Transmission
158
314
312
322
146
Signal To Stroke Control
320
310
318
Amplifier
Transmission Stroke Control
Machine Feed Gearing

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Figure 10 depicts one of three servomechanisms used in controlling a three-axis machining device. In Figure 10, a work piece is supported on a slide or table (element 14). The table is moved by a lead screw (element 302) that is geared to a hydraulic transmission at one end (element 306). In operation, two signals are fed into an amplifier (element 322). The first signal, from a synchro receiver (element 154) indicates the present position of the table. The second signal, from a syncro transmitter (element 146), indicates the desired or command position of the table. The difference between the actual and desired position of the table is transmitted as error signal (along element 320) and is returned to the hydraulic transmission. The error signal then modifies the hydraulic transmission such that the table is moved. The position error is thereby controlled with respect to one of the three axes of the machining device. The error with respect to the other two axes is similarly controlled through the use of command and actual position signals.

Thus, the Forrester patent is similar to the Leaver patent in that it teaches the operation of a machine tool using a feedback system whereby an error signal is used to create a force on the cutting tool to displace the tool to its desired position. The Forester patent is also different from the controller patent in some of the same ways as the Leaver patent. The Forrester patent does not use accelerometers, uses two signals rather than one to produce an error signal, and does not teach that the phase of an accelerometer contains information as to the direction of any departure from the desired position of the cutting tool.

4. The Bower Text

Defendant relies upon the Bower text to show that the use of servomechanisms for correction of error was well known prior to

filing the controller patent application. The Bower text defines a servomechanism as follows:

> We shall certainly call a device a servomechanism if it satisfies the following description:
>
> The device controls some physical quantity by comparing its actual value C with its desired value R and uses the difference (or error) R-C to drive C into correspondence with R.
>
> There is no restriction on the nature of the physical quantity being controlled. It may be position, velocity, temperature, light intensity, chemical composition, or any other measurable and controllable entity the reader may care to name. As a rule, the power required to vary the controlled quantity C is large compared to the power available in the reference input R, so that a servomechanism usually includes power-amplifying equipment. This, however, is incidental. The basic property implied by the foregoing description is feedback, the comparison of output and input, and the control of the output in accordance with its deviation from the desired value. A servomechanism monitors its own performance and makes corrections when necessary.

Thus, the Bower text simply provides some basic information concerning the operation of servomechanisms such as the

servomechanisms employed for displacement of the cutting tool in the Forrester and Leaver patents. The Bower text does not discuss any particular structure and does not specifically discuss the usefulness of these servomechanisms in deep boring operations.

D. The Level of Ordinary Skill in the Art

The parties disagree as to the level of ordinary skill in the art. Plaintiff argues that since the Arsenal is the sole manufacturer of large cannon barrels in the United States, the place to look when assessing the level of ordinary skill in the art is to Arsenal employees. Plaintiff notes that Arsenal employees with pertinent responsibility in cannon manufacture had no college education but significant practice experience with reamers used at the Arsenal for deep boring gun barrels. But it is incorrect to view the controller patent as narrowly involving the manufacture of large cannons. Rather, the controller patent is directed at the design of a machine tool employing a control system to control runout in deep boring operations. All relevant evidence considered (*see Environmental Designs, Ltd. v. Union Oil Co.*, 713 F.2d 693, 696, 218 USPQ 865, 868 (Fed. Cir. 1983), *cert. denied*, 464 U.S. 1043 (1984)), defendant is correct that the pertinent level of ordinary skill in the art in early 1961 was an individual with a bachelor of science degree in electrical engineering with four years of machine tool design experience.

E. Secondary Considerations

So called "secondary considerations" are often "the most probative and cogent evidence" dealing with the issue of nonobviousness. *Stratoflex, Inc. v. Aeroquip Corp.*, 713 F.2d 1530, 1538, 218 USPQ 871, 879 (Fed. Cir. 1983). Herein, the sole alleged commercial success of the controller patent is the alleged

infringement of the patent at the Arsenal. The evidence indicates that there was a long-felt need at the Arsenal for an improved system for controlling runout, that the alleged infringing Arsenal device filled that need, and that the Arsenal device was a significant technological step forward and produced important cost savings.

But "[a] nexus is required between the merits of the claimed invention and the evidence offered, if that evidence is to be given substantial weight enroute to conclusion of the obviousness issue." *Id.* at 1539, 218 USPQ at 879. Defendant argues that the Arsenal device does not infringe the controller patent and, therefore, any commercial success of the Arsenal device should not impact the validity of the patent. In addition, defendant argues that even assuming infringement, the commercial success of the Arsenal device relates to improvements initiated at the Arsenal rather than the structure disclosed in the controller patent. But this court concludes below that the Arsenal device does infringe the claims of the controller patent. Moreover, the evidence viewed *in toto* indicates that the commercial success of the Arsenal device stems in large part from the technological breakthrough described in the controller patent.

F. Analysis and Conclusion – Claims 1, 2, and 5 are Not Obvious in View of the Prior Art

Defendant has failed to overcome the statutory presumption of patent validity because it has not proved that the "differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time of the invention was made to one of ordinary skill in the art." 35 U.S.C. § 103.

As explained above, none of the prior art teaches the

electronic or mechanical control of runout during deep boring operations. The indicator patent and the indicator device involve deep boring and use of an accelerometer to produce an error signal, but do not teach that this signal is indicative of the direction of runout or that the signal can be used to activate a force generating means which can be used to control the direction and magnitude of runout. The remaining references in varying ways teach or suggest the production and the use of error signals for making corrections during machine tool operations, but none discusses the particular problems faced in controlling runout during deep boring of a rotating object, and none discloses any means to produce an effective error signal during deep boring operations. Specifically, there is no suggestion in the prior art that the signal emitted by an accelerometer attached to a boring head contains information as to the direction of runout and can be used as an error signal to generate a restoring force to control runout.

Though the use of error signals, negative feedback, and servomechanisms was prevalent in the early 1960s, until plaintiff made his discovery, the long-felt need for increased control in deep boring of cannons remained unfulfilled. The technological advance described in the controller patent was not rendered obvious by the prior issuance of the indicator patent. The prior art, when considered together and as a whole, simply does not suggest the benefits that resulted from plaintiff's invention or otherwise render obvious to one of ordinary skill in the art the deep boring device covered in Claims 1, 2, and 5 of the controller patent.

VI. Claim 6 is Not Invalid Based on Lack of Utility

Based primarily on the testimony of Russell Tompkins, defendant contends that Claim 6 is invalid because the structure described therein is inoperable and lacks utility. In pertinent part, Claim 6 calls for an electromagnetic "force generating means."

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Defendant argues that if the electromagnetic force generating means disclosed in the controller patent were used, the forging would become magnetized and the inner portion of the forging would attract the metal chips cut during the boring operation. Defendant argues that these chips would "cause havoc in the boring operation," for example, by cutting the insulation from the electrical wires used to generate the electromagnetic force or by gouging or scarring the inner surface of the forging.

But while Tompkins indicated the possibility of problems arising if such an electromagnetic "force generating means" were employed, his testimony does not support a conclusion that the problems would be so significant as to render the claimed device inoperable. Tompkins testified that it would be "very likely" that the forging would be magnetized and attract chips, and that such attraction "*could* cause a lot of havoc" (emphasis added). He did not testify that the chips *would* cause havoc, nor did he precisely define what he meant by havoc. Tompkins testified that he did not know whether the magnetic attraction would result in the chips jamming the clearance between the boring head and the forging "so as to terminate . . . or severely hamper the boring operation." As to possible scarring of the forging, Tompkins did not quantify the amount of scarring likely, did not state that scarring would render any forging unusable, and did not know whether the scarring could be eliminated through inclusion of some simple mechanical device. As to possible cutting of the insulation of the wiring, Tompkins merely indicated that one would have to be "very careful" not to scrape the insulation off the coils. He did not testify that the removal of insulation would necessarily occur, or that it could easily be prevented by careful design.

A patent is presumed to have utility (*Structural Rubber Products Co. v. Park Rubber Co.*, 749 F.2d 707, 714, 223 USPQ 1264, 1269 (Fed. Cir. 1984)), and to overcome this presumption, an

alleged infringer must prove "total incapacity [of the claimed invention] with facts supported by clear and convincing evidence. *Moleculon Research Corp. v. CBS, Inc.*, 793 F.2d 1261, 1269, 229 USPQ 805, 810-11 (Fed. Cir. 1986), *cert. denied*, 479 U.S. 1030 (1987). Tompkins' testimony falls far short of establishing a lack of utility under this standard.

VII. Analysis of Whether the Controller Patent Covers the Arsenal Device

A. Legal Standards

Pursuant to 28 U.S.C. § 1498, a patent owner is authorized to recover just compensation for unauthorized use or manufacture by the United States inventions "covered by a patent," *i.e.*, covered by the patent claims. The legal and factual analysis employed to determine unauthorized use of manufacture under Section 1498 is the same as the analysis used to determine "infringement" under 35 U.S.C. § 271(a) — if the alleged infringing device "infringes" a patent claim it is "covered by" the patent. *Lemelson v. United States*, 752 F.2d 1538, 1548, 224 USPQ 526, 531 (Fed. Cir. 1985). *See also Teledyne McCormick Selph v. United States*, 214 Ct. Cl. 672, 682-85, 558 F.2d 1000, 1005-07, 195 USPQ 261, 265-67 (1977); *Palumbo v. Don-Joy Co.*, 762 F.2d 969, 974, 226 USPQ 5, 7-8 (Fed. Cir. 1985). In both analyses, initially the scope of the relevant claims is ascertained and then a determination is made as to whether the claims as so interpreted cover the accused device. *Id.*

A device can be covered by or infringe (hereinafter infringe) a patent claim in either of two ways. First, the device can literally infringe the claim. Literal infringement results where the claim "reads on" the accused device, *i.e.*, the device contains each and every element and limitation called for in the claim. *Mannesmann*

Demag Corp. v. Engineered Metal Products Co., 793 F.2d 1279, 1282, 230 USPQ 45, 46 (Fed. Cir. 1986). Second, infringement can result under the doctrine of equivalents, when the alleged infringing device and the device defined in the patent claim "perform substantially the same function in substantially the same way to obtain the same result." *Graver Tank Mfg. Co. v. Linde Air Products Co.*, 339 U.S. 605, 608 (1950). Herein, plaintiff alleges both literal infringement and infringement under the doctrine of equivalents for Claims 1 and 2, and infringement under the doctrine of equivalents for Claims 5 and 6.

B. The Alleged Infringing Arsenal Device

Plaintiff alleges that the controller patent covers six distinct lathes used at the Arsenal in the manufacture of gun barrels. The six lathes involve three generations of technology.[11] While the structures of the three generations of machines differ somewhat, the parties have selected the third generation machines as representative and have stipulated that the court's decision on infringement on those machines shall apply with respect to the remaining alleged infringing devices.

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11. The first generation structure was first used in cannon manufacture in 1968. A standard Niles Lathe was adapted with accelerometers to sense runout and a series of hydraulic piston-like elements to move the cutting head back to its desired position. The second generation machine, a modified Century Detroit Lathe, was first used in 1972 in the production of 8 inch and 175mm gun barrels. It also used accelerometers to sense runout and hydraulic pistons to control runout but it differed structually from the Niles Lathe in a variety of ways. The third generation structure, a modified Century Detroit Lathe, was first used in 1975 in the production of 155mm gun barrels. This device used accelerometers to detect runout but employed hydrostatic bearings, instead of rigid pistons, to move the cutting head back to its desired position. This same third generation technology was later employed with other Century Detroit Lathes in the manufacture of 105mm and 8 inch gun barrels.

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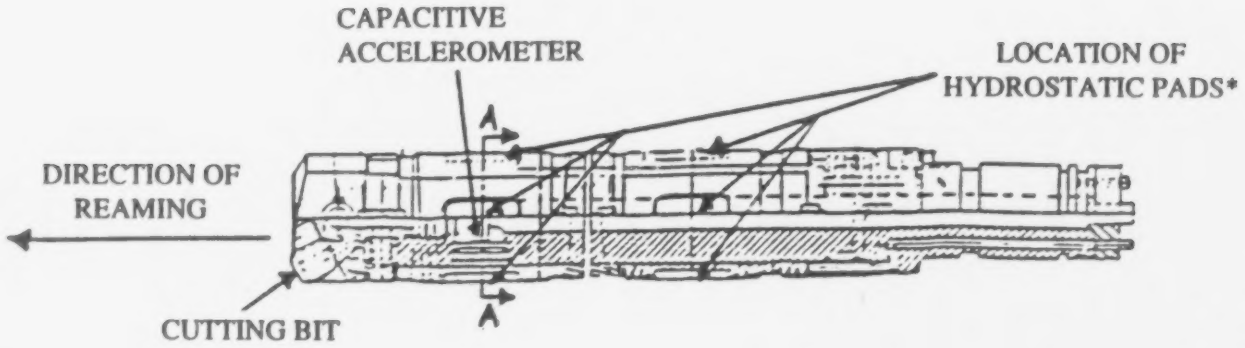
The third generation machines employ a lathe attached to a conventional boring bar. At the end of the bar is a boring head. The boring head contains cutters mounted on its horizontal plane and two capacitive displacement accelerometers mounted at the rear of the cutters, also on the horizontal plane. The accelerometers are capable of detecting the horizontal component of the acceleration of the boring head. Each accelerometer employs a "forcer coil" which is supported by a number of flexure arms. When runout occurs, the acceleration that results causes submicroscopic displacement of the forcer coil. This movement results in an increase in the electrical current flowing through the forcer coil so as to hold the coil nearly stationary. The varying amount of current flowing through the forcer coil is proportional to the amount of acceleration. The increase in the flow of electrical current ultimately results in the production of a sinusoidal signal which is indicative of the direction and magnitude of runout.

The boring head also contains eight hydrostatic bearings (pads or pockets) — a front set of four and a rear set of four. For each set, the four individual pads are referred to as front, rear, top, and bottom, where the front and rear pads are mounted on the horizontal axis of the boring head, and the top and bottom pads are mounted on the vertical axis, respectively.

The following diagrams depict a top view and cross-section of a boring tool, which would be asserted into a forging.

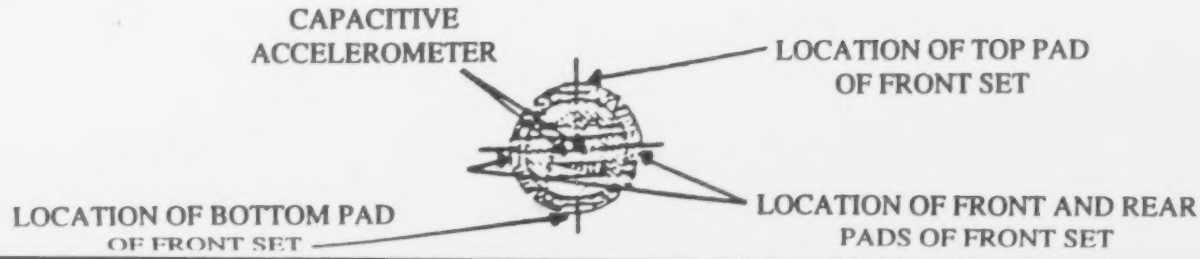
[see diagrams next page]

TOP VIEW OF BORING TOOL



(* LOCATION OF BOTTOM PAD FOR FRONT AND REAR SETS NOT SHOWN.)

A-A CROSS-SECTION OF BORING TOOL



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The amount of fluid in the hydrostatic pockets is controlled by a Moog valve (also referred to as a four-port valve) which in turn is partly controlled by the sinusoidal signal produced by the accelerometers during runout. The Moog valve is connected to a hydraulic pump and has two distinct functions. First, it supplies fluid generally to all eight pads through corresponding ports. When the pads are filled with fluid, they provide support for the cutting head. Second, it transfers fluid between the front and rear pads of the front set through additional ports. This shifting of fluid results in the cutting head moving laterally along the horizontal axis of the bored hole, *i.e.*, when viewed along the longitudinal axis of the gun barrel, the boring head may be shifted toward either the nine o'clock or three o'clock position. For example, the Moog valve could add fluid to the front pad of the front set and simultaneously remove fluid from the rear pad of the front set in order to push the boring head toward the rear pad. Thus, under hydraulic pressure, the front and rear pads of the front set move the cutting head along the horizontal axis of the bored hole, while the rear set provides a rigid support and acts as a fulcrum for moving the cutting head.

The hydrostatic bearings function to correct runout. When runout occurs, the accelerometers emit an electrical signal which ultimately causes the Moog valve to shift fluid between the front and rear pads of the front set. This fluid transfer results in movement of the boring head along the horizontal axis toward the axis of rotation of the forging.

In addition to addressing the problem of runout, the third generation controller addresses the problem of "offset" by using a pair of inductive probes horizontally mounted just behind the cutters on the horizontal plane of the boring head. Like runout, offset involves movement of the cutting head. Offset occurs when the forward end of the boring head, as it travels down the forging, is displaced with respect to the finished bored hole either to the right

or left on the horizontal plane. Offset occurs when an inefficient cutter requires more force than the cutter on the opposite side, or when runout is present. In either case, the boring head is not exactly centered in the finished bored hole. Specifically, offset is calculated as the sum of the two gaps between the boring head and the bored hole on the front and rear sides of the boring head.

Runout and offset are distinct phenomenons in that there can be runout with no offset and offset with no runout. Both, however, are addressed by changing pressure in the hydrostatic bearings. Thus, the hydrostatic bearings correct any runout sensed by the accelerometers as well as any offset sensed by the inductive probes.

C. Claim 1 – Literal Infringement

There is no dispute that the Arsenal device contains elements 1 and 2 of claim 1 – a boring tool and a means for advancing the boring tool. The dispute herein involves elements 3 and 4 of Claim 1.

1. Element 3 of Claim 1 is Literally Infringed

Element 3 calls for:

> means adapted to sense the direction and magnitude of the run-out from said axis to the center of a bored hole made by said cutting head, said sensing means being adapted to generate a run-out signal indicative of said magnitude and direction whereby the position of the boring tool relative to said axis may be determined.

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Defendant does not appear to dispute that the Arsenal acceleometer and related circuitry perform the specific functions called for in element 3, *i.e.*, "sense the direction and magnitude of runout" and "generate a run-out signal indicative of . . . magnitude and direction [of runout]." [12] But when, as here, a claim defines a device by calling for a series of "means" for performing specified functions (*e.g.*, uses "means plus function" language), mere performance of those functions is not enough to produce literal infringement. 35 U.S.C. § 112 provides, in pertinent part:

> An element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof.

Thus, for literal infringement of a claim that employs "means plus function" language, an accused device must not only perform the identical function called for in the claim, but in addition the accused device must employ either "the corresponding structure, material, or acts described in the specification" or "equivalents thereof."

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12. Defendant argues that "[t]he Arsenal device is never concerned with the location of runout." But to correct runout, the force generating means must know when and in which direction to move the boring head. If the boring head is directly to the left of the axis of rotation of the gun barrel, to correct runout the force generating means would have to force the boring head to the right. Since the Arsenal device controls runout, it necessarily utilizes signals containing information as to the direction of runout.

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The controller patent does not describe the use of forcer coil capacitive displacement accelerometers. The issue with respect to literal infringement therefore is whether the forcer coil accelerometer is the Section 112 "equivalent" of the structures described in the controller patent. Defendant interprets Section 112 as requiring that the accused device employ a structure that is "structurally equivalent" to those described in the patent specification and contends that that requirement is not met here. Defendant is incorrect for two reasons. First, the accelerometer employed in the Arsenal device does have a physical structure equivalent to one of the accelerometers referenced in the controller patent. Second, and in any event, defendant interprets Section 112 too narrowly when it defines the term "equivalent" to include only equivalents in physical structure.

The Arsenal Accelerometer Has an Equivalent Physical Structure to the Accelerometers Described in the Controller Patent

While the controller patent specifically describes only one type of accelerometer, a seismic pendulum, it incorporates by reference the disclosure in the indicator patent of two additional types, a capacitive displacement accelerometer and an electrolytic accelerometer.[13] The capacitive displacement accelerometer described in the indicator patent has a physical structure that is so close to the structure of the forcer coil capacitive displacement accelerometer in the Arsenal device that the two accelerometers must be deemed to have "equivalent" physical structures.

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13. Defendant concedes that these two additional accelerometers should be deemed to be described in the controller patent for purposes of determining Section 112 equivalents.

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The capacitive displacement accelerometer described in the indicator patent consists of an electric field formed by three electrodes separated by a suspended hollow metal sphere. One electrode is directly beneath the sphere and emits a current. The other two sensing electrodes are to the left and right of the sphere, respectively. During runout, the sphere moves back and forth between the right and left electrodes as the boring head rotates about the axis of rotation of the forging. This alternating movement results in a sinusoidal electrical runout signal.

The central structural difference between the Arsenal accelerometer and the capacitive displacement accelerometer described in the indicator patent is that the indicator patent accelerometer suspends a sphere between the electrodes while the Arsenal device employs a forcer coil. In both cases, a suspended mass is placed in an electric field formed by a number of electrodes, and acceleration forces caused by runout move the suspended mass closer to and farther from a given supporting electrode. Since these two structures are sufficiently close to be deemed equivalents in physical structure, the Arsenal device would literally infringe element 3 of Claim 1 under defendant's proposed interpretations of Section 112.

Section 112 Does Not Require Equivalent Physical Structures

In any event, however, the term "equivalent" in Section 112 should not be interpreted as being limited to structures that are "equivalent" to the physical structure of the "means" disclosed in a patent. The literal wording of Section 112 contains no such requirement. The statute merely refers to structures "described in the specification and equivalents thereof." It does not state that the only possible "equivalents" to the structures described in the specification are devices with equivalent physical structures, *i.e.*, it does not provide structures "described in the specification and *structural* equivalents thereof."

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The concept of equivalence has meaning in patent law outside of Section 112 and the concept has not been limited to equivalent physical structures. As noted above, a device that does not literally infringe a patent claim may nevertheless be found to infringe the claim under a patent law doctrine called the doctrine of equivalence. The Supreme Court articulated the standards for applying the doctrine of equivalence in *Graver Tank*, 339 U.S. 605. The Court explained that infringement exists if the alleged infringing device and the device defined in the patent claim "perform [] substantially the same function in substantially the same way to obtain the same result." *Id.* at 608. In addition, the Court noted that "[a]n important factor [in the determination of equivalence] is whether persons reasonably skilled in the art would have known of the interchangeability of an ingredient not contained in the patent with one that was." *Id.* at 609. Thus, under the *Graver Tank* standards, a finding could be made that two devices are Section 112 "equivalents" and, hence, that infringement exists even when the two devices are different "in name, form or shape," *id.* at 608, *i.e.*, even if there was no equivalence in the physical structures.

It is appreciated that applying the doctrine of equivalence is distinct from determining literal infringement of a claim using means plus function language under 35 U.S.C. § 112. But in using the term "equivalents" in Section 112, Congress intended to reference the *Graver Tank* concepts of equivalence. As explained in *Palumbo*, 762 F.2d at 975 n.4, 226 USPQ at 8-9 n.4:

> Although, as we pointed out in *D.M.I., Inc. v. Deere & Co.*, [755 F.2d 1570, 225 USPQ 236 (Fed. Cir. 1985)], there is a difference between a doctrine-of-equivalents analysis and a literal infringement analysis involving "equivalents" under § 112, *Graver Tank*

concepts of equivalents are relevant in any "equivalents" determination. The fact that *Graver Tank* preceded the 1952 Patent Act by two years and the last paragraph of § 112 was new, *see* Reviser's Note, 35 U.S.C. § 112, H.R. Rep. No. 1923, 82d Cong., 2d Sess. 19 (1952), suggests that the Underlying principles of equivalents in *Graver Tank* could be used in a § 112 literal infringement analysis. *Accord Hale Fire Pump Co. v. Tokai*, 614 F.2d 1278, 205 USPQ 123 (CCPA 1980) (applying the *Graver Tank* concepts of equivalents in construing a "means" clause); and *Lockheed Aircraft Corp. v. United States*, 553 F.2d 69, 193 USPQ 449 (Ct. Cl. 1977) (*Graver Tank* interchangeability test used in interpreting a "means plus function" claim for literal infringement purposes).

Limiting Section 112 "equivalents" to objects that are structurally equivalent to those objects described in a patent specification would undermine Congress' intent in 1952 in adding the third paragraph of Section 112. By specifically authorizing the use of "means plus function" terminology, Congress apparently recognized that such terminology can be a highly efficient way to draft a patent claim, *i.e.*, to define the metes and bounds of the patentee's invention. However, limiting literal infringement of "means plus function" claims to objects that have physical structures equivalent to those objects specifically described in the patent specification could seriously undermine the usefulness of such claims. Under such an interpretation, literal infringement of a claim may be avoided simply by replacing the structures specifically described in the patent specification with known functional equivalents that operate in substantially the same way but have fundamentally different structures. To avoid such a result,

a patent owner would reasonably have to include in the patent specification an exhaustive list of structures that possibly could perform each function described in the claim. For example, if a claim calls for a means for detecting acceleration, to be assured of broad "literal" coverage a patentee would have to list virtually every known accelerometer structure that could function in the patented device.

All structures that perform a particular function described in a claim fall within the *literal* terms of that claim element, expressed simply as a "means" for performing that function. Congress sought to narrow the scope of literal infringement of such a claim somewhat by providing that the claim encompass only the structure described in the specification and "equivalents" thereof. But defendant has not pointed to anything in the language of Section 112, the pertinent legislative history, or any patent law policy that requires resort to an artificially narrow interpretation of the term "equivalent" which would exclude from literal infringement structures that at the time of the patent's issuance were known to perform the same function, operate in substantially the same way, and achieve the same result as the structures described in the patent's specification. Equivalence of physical structure may be an appropriate part of the analysis but it is not a *sine qua non* for a finding of Section 112 "equivalents."[14]

Applying the *Graver Tank* concepts, the Arsenal's capacitive displacement accelerometer and related circuitry would be "equivalent" to each of the three accelerometers disclosed in the

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14. In *Pennwalt Corp. v. Durand-Wayland, Inc.* 833 F.2d 931, 4 USPQ2d 1737 (Fed. Cir. 1987), *cert. denied*, 485 U.S. 961 (1988), the Court of Appeals for the Federal Circuit used the term "equivalent structure" in defining the requirements of 35 U.S.C. § 112. The court stated: "To determine whether a claim limitation is met literally, where expressed as a means for performing a stated function, the court must (Cont'd)

controller patent. Based on the totality of the evidence submitted at trial, the court concludes that persons reasonably skilled in the art knew at the time the patent was issued that, after appropriate and obvious modification, the Arsenal accelerometer and related circuitry would be interchangeable with any of the three accelerometers referenced in the controller patent. Moreover, the Arsenal device qualifies as a Section 112 equivalent under the tripartite function-way-result test of *Graver Tank*. Whether viewed in isolation or viewed as a part of a runout controller, the Arsenal's capacitive displacement accelerometer performs the same function in substantially the same way and accomplishes the same result as the accelerometers referenced in the controller patent. They all function to detect acceleration and thereby detect runout, and the result of their use is a signal indicative of the direction and magnitude of runout. Clearly, there are some differences in the way the accelerometers operate, but, when all facts are considered, they operate in substantially the same way. Each device converts movement of a mass into a sinusoidal electrical signal which contains information pertaining to both the direction and magnitude of runout. Thus, the Arsenal device literally infringes element 3 of Claim 1.

(Cont'd)
compare the accused structure with the disclosed structure, and must find *equivalent structure as well as identity of claimed function for that structure. Palumbo v. Don-Joy*, 762 F.2d 969, 975, 226 USPQ 5, 8 (Fed. Cir. 1985)." *Pennwalt*, 833 F.2d at 934, 4 USPQ2d at 1739 (emphasis added.) But the court cited *Palumbo* as support for this position and, as cited above, *Palumbo* interpreted Section 112 as involving *Graver Tank* concepts of equivalence. Hence, it does not appear that the *Pennwalt* court intended to adopt the position that equivalence of physical structure is a *sine qua non* for literal infringement under Section 112.

Appendix D

2. Element 4 of Claim 1 is Literally Infringed.

Element 4 calls for:

> force generating means adapted to provide a force acting on the cutting head to cause radial displacement of said cutting head responsive to said run-out signal whereby said run-out may be controlled in direction and magnitude.

Defendant contends that the Arsenal device does not literally infringe element 4 on two grounds. First, defendant contends that the hydrostatic bearings in the Arsenal device do not perform the identical function called for in element 4 in that they do not "cause radial displacement of said cutting head responsive to said run-out signal." Second, defendant contends that, in any event, the hydrostatic bearings in the Arsenal device are not "equivalent" to the pertinent structures specifically described in the controller patent and, therefore, pursuant to the last paragraph of Section 112, the Arsenal device does not literally infringe element 4.

The Hydrostatic Bearings Perform the Identical Function Called For in Element 4

Since the hydrostatic bearings in the Arsenal device are located on the horizontal plane of the boring head behind the cutters, the bearings always exert pressure on the cutters to move the boring head to the left or right. The following diagram shows the motion of an offset boring head within a rotating forging. The boring head commences at point 1 (with runout to the right of the center of rotation) and, as the forging rotates, the boring head moves about the center of rotation of the forging from position 1 through position 8. The arrows indicate the direction in which the

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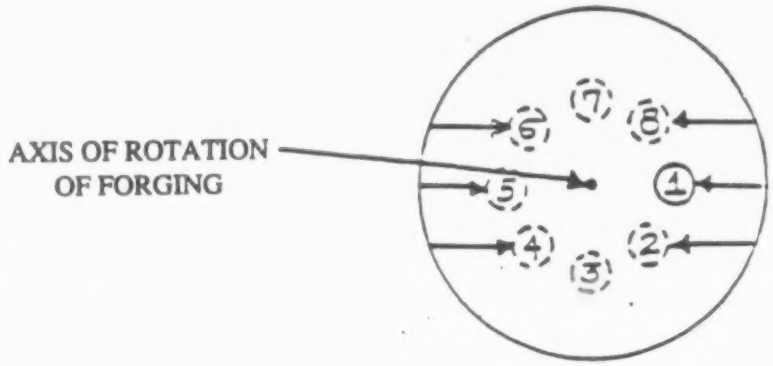
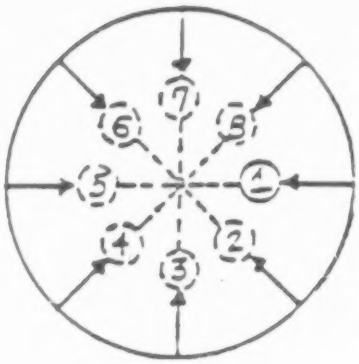
hydrostatic bearings push the boring head to correct runout during one complete rotation of the forging.



Defendant contends that the claim term "radial" means the passage of an entity, such as a force or vector, through a center and, hence, that radial displacement refers to the direction of movement depicted as arrows below for the eight runout positions.



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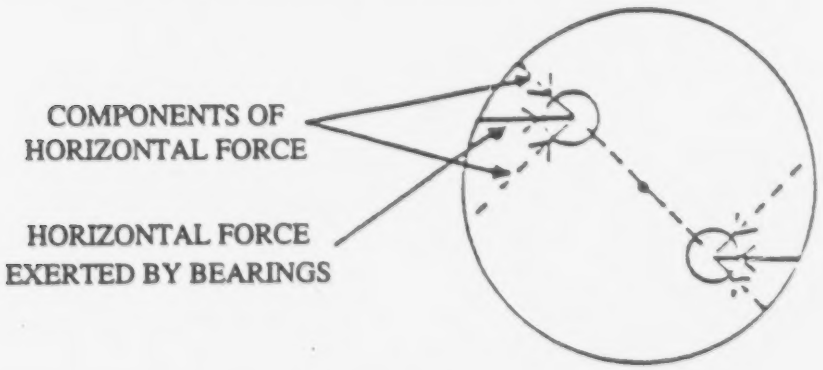
Defendant argues that because the hydrostatic bearings in the Arsenal device always apply a horizontal force on the boring head, they do not "cause radial displacement of the cutting head" and therefore do not perform the function set forth in element 4. But this argument, which was not directly supported by defendant's own expert, [15] is unconvincing for a number of reasons.

First, as is apparent from a review of the two above diagrams, it is not disputed that at positions 1 and 5 the force applied by the hydrostatic bearings is undeniably radial in nature, *i.e.*, it passes through the center of rotation of the forging. Each of these positions occurs during every revolution of the forging. Therefore, at least at these two points, the Arsenal device performs the function called for in element 4.

Next, with respect to positions 2, 4, 6, and 8, though the restoring force in the Arsenal device is horizontal in direction, pursuant to basic principles of physics, that horizontal force can be broken down into two distinct components, one of which is radial in nature. The following diagram shows horizontal forces broken into such components for positions 2 and 6.



15. Edward E. Kirkham testified that he did not have an opinion as to whether (Cont'd)

Thus, at each position, except where the boring head is directly above (position 7) or directly below (position 3) the axis of rotation, the boring head is subjected to a component of radial force, the effect of which is to displace the boring head toward the center of rotation of the forgoing.

Finally, and in any event, element 4 does not require that the restoring force actually be radial in nature. Element 4 requires only that the force *cause* the radial displacement of the boring head. In the Arsenal device, the restoring force causes the radial displacement of the boring head in that it functions to displace the boring head from its runout position back to its desired position, *i.e.*, the ultimate movement of the boring head is in a radial direction toward the center of rotation of the forging. For these reasons above, the Arsenal device performs the identical function called for in element 4.

The Hydrostatic Bearings in the Arsenal Device are the Section 112 Equivalents of the Structures Disclosed in the Controller Patent

Defendant contends that the Arsenal device does not literally infringe element 4 because the sole structure described in the controller patent that functions as a "force generating means" is an electromagnetic yoke, and the hydrostatic bearings in the Arsenal device are not Section 112 "equivalents" of that yoke. But this argument misreads the controller patent. While there is some ambiguity, it appears that in addition to disclosing use of an electromagnetic yoke, the controller patent discloses the use of a

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(Cont'd)
the Arsenal device contains a force generating means, adapted to provide a force acting on the cutting head to cause radial displacement of the cutting head in response to a runout signal.

hydraulic piston as a force restoring means for controlling runout. Both the disclosed piston (*see, e.g.*, Figure 11) and the Arsenal's hydrostatic bearings are "hydraulic" in operation in that they move the boring head by utilizing fluid under pressure. The structures of these two hydraulic mechanisms are sufficiently close so as to be "structurally equivalent." Moreover, they perform substantially the same function in substantially the same way (both are hydraulic) to achieve the same result and, therefore, are properly considered "equivalents" under 35 U.S.C. § 112.

In any event, even assuming that the controller patent were not interpreted as describing a hydraulic piston as a force generating means, literal infringement would still exist because the record evidence supports a conclusion that the hydrostatic bearings in the Arsenal device are Section 112 equivalents to the electromagnetic yoke in the controller patent.

The evidence indicates that persons reasonably skilled in the art at the time the patent was issued would have known the Arsenal's hydrostatic bearings, with limited and obvious modifications, would be interchangeable with the electromagnetic yoke described in the controller patent.[16] At that time,

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16. At trial, plaintiff sought to exclude the testimony of defendant's replacement expert, Edward E. Kirkham, on the issue of whether the Arsenal's hydrostatic bearings are equivalent to the electromagnetic yoke described in the controller patent. Plaintiff argued, *inter alia*, that defendant's original expert witness never addressed this issue and, therefore, the court should not permit the replacement expert to testify on that issue. A replacement expert was required because defendant's original expert became emotionally distressed during his testimony and was physically unable to complete cross-examination. But defendant intended to question its original expert on this issue but cut short his direct testimony because he was behaving erratically. All factors considered, it is appropriate to permit defendant's replacement expert to testify on this issue. Plaintiff was not prejudiced and had an opportunity to rebut the replacement expert's testimony.

electromagnetic and hydraulic systems generally were recognized as functional substitutes in the control of machine tools. In his original notebook disclosure of his controller device, plaintiff described the "force generating means" as "hydraulic, electromagnetic, or pneumatic." Similarly, when plaintiff disclosed his concept to defendant, he indicated that a "hydraulic" system could be substituted for a proposed electromagnetic system. Interchangeability is further evidenced by claims 2, 3, and 6 of the controller patent which call for hydraulic, pneumatic, and electromagnetic force restoring means, respectively. *See e.g., Palumbo*, 762 F.2d at 974-75, 226 USPQ at 8 (other claims in the patent may be considered in construing the scope of a "means plus function" claim).

The Arsenal device passes the tripartite function-way-result test of *Graver Tank*. As explained above, the Arsenal hydrostatic bearings perform the same function as the controller patent's electromagnetic yoke because they both cause radial displacement of the cutting head in response to a sinusoidal runout signal. In addition, they both produce the same result — the movement of the boring head from a runout position to the center of rotation of the forging. Defendant argues that the two systems function in a fundamentally different way, but that argument rests to a significant extent on its conclusion, rejected above, that the hydrostatic bearings do not force the boring head in a radial direction.

The operation of the hydrostatic bearings is described above. The electromagnetic yoke, as described in the patent, operates like the hydrostatic bearings by receiving a sinusoidal signal containing information concerning the magnitude and direction of runout, and then responding to that signal by forcing the boring head toward the center of rotation of the gun barrel. The

electromagnets are positioned in quadrature and are sequentially energized. This results in a rotating radial restoring force throughout the 360^0 of rotation.

Defendant contends that because the hydrostatic bearings produce only a horizontal restoring force, they operate in a fundamentally different way than the electromagnetic yoke. But contrary to defendant's allegations, as explained above, the force exerted by the hydrostatic bearings on the boring head can be characterized as being radial in nature. With the sole exception of when the boring head is precisely above and precisely below the center of rotation, there is a radial component to the restoring force produced by the hydrostatic bearings. The absence of exertion of a radial force at these two positions is a minimal distinction and does not warrant a conclusion that the two devices operate in significantly different ways. All facts considered, while the hydrostatic bearings and the electromagnetic yoke do not operate in an identical way, they can be said to operate in "substantially the same way."

In summary, plaintiff has established that the accused Arsenal device contains each of the four elements called for in Claim 1 and, hence, that Claim 1 covers the Arsenal device and is literally infringed.[17]

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17. Defendant argues that even if the Arsenal device literally infringes Claim 1, such infringement occurred by "a coincidence of happenstance rather than [by] design" and, therefore, no infringement exists under the reverse doctrine of equivalents. *See, SRI Int'l v. Matsushita Elec. Corp.* 775 F.2d 1107, 1123, 227 USPQ 577, 587 (Fed. Cir. 1985). But the record evidence does not suggest that the Arsenal device is "so far changed in principle from [the Claim 1 device] that it performs the same or similar function in a substantially different way." *Graver Tank*, 339 U.S. at 608. To the contrary, as explained above, the Arsenal device operates in substantially the same way as the device disclosed in the controller patent.

Appendix D

D. Claim 1 – Infringement Under the Doctrine of Equivalents

Plaintiff presents the alternative argument that if claim 1 is not deemed literally infringed it should be held infringed under the doctrine of equivalents. "When literal infringement under section 112 paragraph 6 is not present the doctrine of equivalents may nevertheless apply . . . ." *Texas Instruments, Inc. v. United States Int'l Trade Comm'n*, 805 F.2d 1558, 1571, 231 USPQ 833, 841 (Fed. Cir. 1986). The range of equivalents allowed to a particular patentee "depends upon and varies with the degree of invention," *Continental Paper Bag Co. v. Eastern Paper Bag Co.*, 210 U.S. 405 (1908), with a pioneer patent entitled to a broad range of equivalents, *Hildreth v. Mastoras*, 257 U.S. 27 (1921).

Herein, the controller patent is properly classified as a "pioneer patent." Plaintiff apparently is the first person to design a device that corrects runout during deep boring operations. Though the problem of runout has existed for decades, there was no prior art cited that sought to address runout through a self-correcting boring head.

As this court concluded above, the accused Arsenal device performs each of the functions called for in elements 1 through 4 of Claim 1 and does so by using devices that are identical or equivalent to those particular devices described in the specification of the controller patent. For the reasons generally set forth in those above discussions, when the device defined in Claim 1 is considered as a whole and compared with the accused Arsenal device, it is apparent that both devices perform the same function, work in substantially the same way, and achieve the same overall result. *Pennwalt*, 833 F.2d at 934, 4 USPQ2d at 1739; *Graver Tank*, 339 U.S. at 608. Therefore, even if this court were incorrect and

plaintiff had not established literal infringement of Claim 1, plaintiff has established infringement under the doctrine of equivalents.

E. The Arsenal Device Infringes Claims 2, 5 and 6

Claim 2

Claim 2, dependent upon Claim 1, adds the further limitation to element 4 of Claim 1: "wherein said force generating means are hydraulic means." Defendant's own expert witness conceded that hydraulic means, "broadly speaking," encompass the Arsenal device's hydrostatic bearings. Therefore, the additional limitation in Claim 2 would not result in a different infringement conclusion for Claim 2 than Claim 1.

Claim 5

Claim 5, also dependent upon Claim 1, adds the further limitation to element 3 of Claim 1:

> A device as in Claim 1 wherein said means to generate a run-out signal comprise movable means mounted on said boring tool for sensing movement of the boring tool, whereby upon said boring tool being subjected to run-out, the center of said boring tool orbits about the said center line and imparts oscillatory motion to said movable means, and electrical means responsive to the movement of said movable means for indicating the existence and degree of run-out, wherein said movable means includes a pendulum member hingedly

> mounted on the center line of said boring tool and vibrating in response to the orbital motion of said boring tool, and wherein said electrical means include a rotary variable differential transformer, wherein said transformer is sinusoidally modulated by said pendulum swings.

Plaintiff concedes that the accused Arsenal device does not literally infringe Claim 5 because the capacitive displacement accelerometer and related circuitry in the Arsenal device differ structurally from the "moveable means" and related "electrical means" specifically called for in Claim 5. The issue, therefore, is whether infringement exists under the doctrine of equivalents.

In arguing against application of the doctrine of equivalents, defendant stresses the structural differences between the capacitive displacement accelerometer and related circuitry employed in the Arsenal device and the "moveable means" and "electrical means" called for in Claim 5. Defendant contends that the Arsenal accelerometer is not hinged mounted, does not experience occilatory swings, and, in addition, does not employ a rotary variable differential transformer to transform motion into an electrical signal. But identity of structure and operation is not required for infringement under the doctrine of equivalents. For each element set forth in Claim 5, there is a corresponding "substantially equivalent" structure in the Arsenal device. *See Pennwalt*, 833 F.2d at 935, 4 U.S.P.Q.2d at 1739-40. The forcer coil in the Arsenal device corresponds to the pendulum member in Claim 5. Both vibrate (the forcer coil submicroscopically) in response to the orbital motion of the boring tool. As to the electrical circuitry, while the Arsenal device does not employ a rotary differential transformer, it utilizes capacitive circuitry to

accomplish the function of such a transformer, *i.e*, transforming the movement of the accelerometer into a sinusoidal signal.

All facts considered, plaintiff has established infringement under the doctrine of equivalents. The Arsenal device performs the same function and achieves the same overall result as the claimed device. While the two devices do not operate identically, they operate in substantially the same way. In both devices, an accelerometer is attached to a boring head, the accelerometer contains a part that moves when runout occurs, the movement ultimately results in a sinuoidal signal indicative of the magnitude and direction of runout, and the signal is then translated into a force that moves the cutting head back to the center of rotation of the forging. In addition, persons reasonably skilled in the art knew at the time the patent was issued that after appropriate and obvious modification the Arsenal accelerometer and related circuitry would be interchangeable with the controller patent's seismic pendulum.[18]

Claim 6

Claims 1 and 6 are independent. On the infringement issue, the pertinent difference between Claim 6 and Claim 1 is that Claim 6 specifically requires that the force generating means be electromagnetic in nature. Since the hydrostatic bearings used in the Arsenal device are not electromagnetic, the Arsenal device does not contain each of the elements called for in Claim 6 and, hence, does not literally infringe Claim 6. The issue again, therefore, is whether infringement exists under the doctrine of equivalents.

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18. As explained above, the indicator patent specifically describes a capacitive displacement accelerometer (structurally equivalent to the Arsenal's) as being interchangeable with a seismic pendulum.

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In the discussion of infringement of Claim 1 above, this court concluded that the hydrostatic bearings in the Arsenal device are the Section 112 "equivalents" of the electromagnetic yoke described in the controller patent. Based on that discussion and conclusion, when the device defined in Claim 6 is considered as a whole and compared with the Arsenal device, it is apparent that both devices perform the same function, work is substantially the same way, and achieve the same overall result. *Id.* at 934, 4 USPQ2d at 1739; *Graver Tank,* 339 U.S. at 608. Therefore, the court concludes that plaintiff has established infringement of Claim 6 under the doctrine of equivalents.

VIII. Laches

There is no dispute that this action was filed with the time period provided in the controlling statute of limitations. Defendant contends, however, that while plaintiff satisfied the statutory filing requirements, plaintiff's delay in filing this action warrants dismissal under the judicially created doctrine of laches.

A. Legal Standards for Laches

In patent cases, a successful laches defense bars recovery of damages for any infringement that occurred prior to the filing of suit. *Jamesbury Corp. v. Litton Industrial Products, Inc.,* 839 F.2d 1544, 1551, 5 USPQ2d 1779, 1785, *cert. denied,* 109 S.Ct. 80 (Fed. Cir. 1988). Since the doctrine of laches is equitable in nature, acceptance of a laches defense is within the trial court's reasonable discretion and depends upon consideration of all facts in a particular case. At a minimum, an alleged infringer must establish an unreasonable and inexcusable delay in asserting a laches defense, and a material prejudice to it resulting from that delay. *Id.* at 1551-52, 5 USPQ2d at 1785. The period of delay is measured

from the time the patent owner knew, or in the exercise of reasonable diligence should have known, of the alleged infringing activity. *Id.* at 1552, 5 USPQ2d at 1785. Where the patent owner's delay in filing suit exceeds six years, a rebuttable presumption arises that the delay was unreasonable and that the alleged infringer was materially prejudiced.

B. Plaintiff's Efforts to Determine Whether the Arsenal Device Infringed the Controller Patent

Plaintiff suspected the device developed by Bergen infringed his controller patent and made inquiries to the Arsenal about such infringement in late 1966. In a November 22, 1966, letter, counsel for the Arsenal responded. Based on the advise of Leon Newman, patent advisor to the Arsenal, Arsenal counsel advised plaintiff that the Bergen device did not infringe the controller patent because the device accomplished its sensing operation "without actually determining the direction and magnitude of the runout."

Plaintiff did not, however, accept this conclusion and, in 1967, filed an administrative claim alleging infringement. Plaintiff's claim was denied in a March 25, 1968, letter in which the Arsenal asserted that "the only procurement of significance to the claim is [the Bergen procurement]" and that the Bergen device, in effect, did not infringe the patent for two distinct reasons. First, the Bergen device "was purchased for research and development purposes, and therefore its use is experimental use not constituting infringement." Second, the Bergen device was structurally different than the device described in the controller patent. The letter contained an attachment under the heading "Comparison of Claims with Procurement." The comparison, prepared by Newman, stated that unlike Claim 1 of the controller patent, the accused Arsenal device, *inter alia*, had "[n]o means adapted for

sensing of direction or magnitude of run-out. No means adapted to generate a run-out signal indicative of the same." The letter focused exclusively on the Bergen device and made no mention that the Arsenal had assembled its own control device for deep boring.

Thereafter, in a May 1968 meeting with a Bergen employee, plaintiff secured additional information suggesting that the Bergen device was covered by plaintiff's patent. The employee indicated, in effect, that after two years of struggling unsuccessfully at the Arsenal to design around the controller patent, Bergen had proceeded to design according to the patent.

In a March 16, 1970, letter, plaintiff informed the Arsenal of the Bergen employee's statement and offered the Arsenal a license under his patent if it purchased a runout controller from FCA. When plaintiff made this offer he did not know that the Arsenal's use of guided boring had extended beyond the use of the Bergen device for experimental purposes. In a response dated April 8, 1970, Newman refused plaintiff's offer and stated that "there has not been any change in the facts on which the [Arsenal] based its 25 March 1968 denial of [plaintiff's] administrative claim for patent infringement." The letter did not mention that the Arsenal had developed a bore guidance device in house and as of December 1968 used the device to control the deep boring of an object rotating about an axis.

On May 26, 1977, an article appeared in the *Times Union* newspaper describing an award given to Wondisford for the development of a guided boring system for gun barrel manufacture. With the knowledge that the Arsenal had successfully used a guided boring device in the production of gun barrels, plaintiff sought to determine whether the device infringed

his controller patent. In an effort to save the expense of a legal action, in an August 26, 1977, letter plaintiff requested Congressman Stratton to institute a congressional investigation. On April 6, 1978, Congressman Stratton suggested that plaintiff present his claim to the United States Court of Claims. Plaintiff and his counsel requested an opportunity to inspect the equipment at the Arsenal. The Arsenal permitted an inspection on March 13, 1979. Thereafter, on June 12, 1979, plaintiff filed a second administrative claim alleging infringement. The claim was denied on October 1, 1980, and plaintiff filed the instant action five days later, on October 6.

C. Defendant has not Established a Laches Defense

Defendant contends that the evidence presented at trial supports a conclusion that plaintiff knew, or reasonably should have known, about the Arsenal's alleged infringing activity by at least 1971. Hence, defendant argues, the delay in filing suit was in excess of six years and the presumption developed in the case law of unreasonable delay and prejudice should apply.

Clearly, plaintiff suspected that the Bergen device infringed his patent as early as 1966, and the 1968 statements by a Bergen employee served to confirm that suspicion. But Arsenal representatives informed plaintiff that the Bergen device had been used exclusively for experimental purposes, and plaintiff apparently had no reason to doubt that representation. Since, as defendant implied, experimental use may not constitute infringement, *Chesterfield v. United States*, 141 Ct. Cl. 838, 845-46, 116 USPQ 445, 448 (1958), plaintiff's decision not to bring suit in 1971 based on his knowledge of the Berger device appears clearly reasonable. In fact, as summarized above, the Arsenal never used the Bergen device commercially but instead developed

its own commercial guided boring device. The crucial question in assessing whether laches should apply, therefore, is what did plaintiff know about the commercial device the Arsenal had developed and when did he know it. The ultimate answer is that prior to 1978, plaintiff did not know enough about the structure of the Arsenal device for the court to render his failure to institute suit either unreasonable or unexcusable.

Despite plaintiff's frequently expressed concerns about the Arsenal possibly infringing his patent, Arsenal personnel did not inform plaintiff directly that gun barrels were being produced at the Arsenal using guided boring machines. Indeed, in his 1970 letter to plaintiff, Newman represented that there had not been any change in the facts upon which defendant based its denial of plaintiff's 1968 administrative claim even though, in fact, the Arsenal had developed a guided boring device which already had been used to control the deep boring of an object rotating about an axis.

The evidence that most strongly supports a conclusion that plaintiff was aware of the Arsenal's guided boring device is plaintiff's 1977 letter to Congressman Stratton. Therein, in reviewing the pertinent history, plaintiff refers to a May 1971 letter he had received from Folsom. Plaintiff stated:

> On May 28th, 1971, a letter from William Folsom to de Graffenried reported on a conversation which Folsom had with [an Arsenal employee]. The gist was:
>
> 1. the Arsenal now has 4 or 5 Runout Systems

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2. they do not expect to buy any more

3. they expect to release the technical information soon on same

4. to get the technical information, write to Commanding Officer, Watervliet Arsenal

5. Bethelehem Steel may soon buy a system.

But, while this reference indicates that in 1971 plaintiff knew there were runout systems being used at the Arsenal, there is no evidence in the record indicating that plaintiff had direct knowledge at that time, or any time prior to 1978, of the physical structure of the controllers used at the Arsenal. Plaintiff could not conclude that his patent was being infringed simply from the Arsenal's use of a runout controller. Plaintiff originated and patented one possible concept for controlling runout, and plaintiff was not in a position to conclude that any runout controller developed by the Arsenal would necessarily or even likely be covered by his patent.

Indeed, plaintiff took all of the steps reasonably possible, short of instituting suit, to determine whether the Arsenal was being forthright in its allegations of noninfringement. The structure of the Arsenal device could not be determined by examining a finished gun barrel. Therefore, to determine whether the controllers used at the Arsenal were covered by his patent, plaintiff had to inspect the actual Arsenal device or blue prints depicting its structure. But the Arsenal is a restricted area and plaintiff could not make such an inspection without the Arsenal's authorization. Plaintiff had arranged for an inspection on February

2, 1967, but when plaintiff and his counsel arrived at the Arsenal, the previously granted authorization was revoked. Another request had been denied in 1968.

When the facts presented at trial are viewed *in toto*, the equities clearly favor reaching the merits of plaintiff's cause of action. While plaintiff made his allegations of infringement directly and clearly, defendant was much less forthright in its responses. Even assuming there were no intentional misrepresentations by Arsenal employees, their actions appear carefully crafted as to discourage plaintiff from pursuing the matter further and thereby to avoid any infringement litigation against the Arsenal. The Arsenal letters focused exclusively on the Bergen device and did not disclose the existence of the far more significant control boring system being developed and used internally at the Arsenal. Moreover, the Arsenal did not disclose the structure of the Bergen device, including its use of accelerometers, but instead merely described the device in a conclusory fashion. When plaintiff sought a viewing of the device to determine its structure, defendant refused.[19]

In sum, the record evidence indicates that plaintiff did not know the structure of the device being used commercially at the

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19. Defendant contends that it has been prejudiced by the delay in instituting suit in that the memories of witnesses have faded, documents were lost, an important government witness died, and the Arsenal procured additional bore guidance devices. In response, it cannot be disputed that a trial conducted years earlier would have been more efficient for resolving disputed issues of fact. But it is not apparent that the delay necessarily harmed defendant any more than it harmed plaintiff. Moreover, for the reasons described above, the delay is attributable more to defendant's conduct than to plaintiff's. Had defendant apprised plaintiff of the structure of the Arsenal device in 1971, plaintiff could have bought suit then and the instant dispute would have been resolved long ago.

Arsenal until 1978 when the Arsenal first permitted plaintiff to view its guided boring device. Prior to 1978, plaintiff exercised reasonable diligence in his effort to determine whether his patent was being infringed at the Arsenal but, based in part on defendant's actions, did not uncover significant information suggesting infringement.[20] This fact pattern does not remotely favor this court exercising its equity power in a manner that would free defendant from liability it otherwise would have for the unauthorized use of plaintiff's patent property. The defense of laches is therefore denied.

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20. Plaintiff testified that one of the reasons he did not institute suit earlier was that he had insufficient funds. In evaluating a laches defense, courts have generally held that a lack of funds does not excuse an otherwise unreasonable delay in filing suit. *See, e.g., Hayward v. National Bank*, 96 U.S. 611, 618 (1878); *Casey v. United States*, 226 Ct. Cl. 584, 586 (1981); *Naxon Telesign Corp. v. Bunker Ramo Corp.*, 686 F.2d 1258, 1261, 216 USPQ 658, 660 (7th Cir. 1982). But plaintiff's lack of funds was not the sole reason plaintiff did not institute suit. More importantly, the issue is not whether plaintiff could have filed a patent suit against defendant but rather was plaintiff equitably obliged to file suit based on the information he had. For the reasons set forth above, the answer to the latter question is no.

Appendix D

Conclusion

For the reasons set forth above, plaintiff has demonstrated that Claims 1, 2, 5, and 6 of the controller patent cover the Arsenal device, and defendant has failed to demonstrate that the claims are invalid or that plaintiff's cause of action is barred by the doctrine of laches. Plaintiff, therefore, has established defendant's liability and the sole remaining issue is damages. On or before June 11, 1990, the parties shall file a joint status report proposing further scheduling on the damage issue.

IT IS SO ORDERED.

s/ Roger B. Andewelt

ROGER B. ANDEWELT
Judge

APPENDIX E — UNITED STATES CLAIMS COURT ACCOUNTING OPINION

IN THE UNITED STATES CLAIMS COURT

No. 541-80C

(Filed: January 31, 1992)

ALBERT L. DE GRAFFENRIED,

Plaintiff,

v.

THE UNITED STATES,

Defendant.

Patents; accounting; reasonable and entire compensation under 28 U.S.C. § 1498; determining a reasonable royalty for a patent license; cost savings to the licensee as a measure of compensation; royalties based on the number of times a patented apparatus is used (per-use royalty) or the number of items manufactured using a patented apparatus (throughput royalty); lack of *de minimis* exception to compensation under Section 1498.

Richard C. Conover, Bozeman, Montana, for plaintiff.

Chun-I Chiang, with whom were *Assistant Attorney General Stuart M. Gerson* and *Vito J. DiPietro,* Director, Washington, D.C., for defendant. *John Fargo,* of counsel.

Appendix E

OPINION

ANDEWELT, Judge.

In this patent action filed pursuant to 28 U.S.C. § 1498, plaintiff, Albert L. de Graffenried, seeks compensation from the United States for the unauthorized use of a device covered by certain claims of plaintiff's patent, United States Patent No. 3,217,568 (the '568 patent). In a prior decision, this court held that (1) the pertinent claims of the '568 patent are valid, (2) those claims cover a controller system used in the guided boring of large gun barrels at the Watervliet Arsenal in Watervliet, New York (the Arsenal), and (3) plaintiff's suit is not barred by the doctrine of laches. *De Graffenried v. United States*, 20 Cl. Ct. 458 (1990) *(De Graffenried I)*. The sole remaining issue is the amount of compensation to which plaintiff is entitled. This decision sets the parameters of plaintiff's compensation award.

I.

Section 1498 provides, in pertinent part:

> (a) Whenever an invention described in and covered by a patent of the United States is used or manufactured by or for the United States without license of the owner thereof or lawful right to use or manufacture the same, the owner's remedy shall be by action against the United States in the United States Claims Court for the recovery of his reasonable and entire compensation for such use and manufacture.

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To determine "reasonable and entire compensation" under Section 1498, the court must determine first which machines used at the Arsenal should be part of the calculus when assessing compensation and second what is the appropriate level of compensation for the unauthorized use of those machines.

Plaintiff contends that he is entitled to compensation for the Arsenal's use of twelve different guided boring lathes that employ a controller system covered by the '568 patent. Defendant disagrees and contends that compensation should be allowed only for the following four:

Identification Number	Size of Gun Barrel Produced	Date of First Use in the Manufacture of Gun Barrels
WV 11235	155 mm	December 1974
WV 11205	105 mm	June 1976
WV 11225	8"	January 1977
WV 11190	105 mm	October 1978

The remaining eight guided lathes in dispute can be divided into three groups. The first group consists of two lathes, referred to by the parties as the Bergen device and the modified Bergen device. These lathes were developed in part by Arsenal personnel and were used in assessing whether guided boring was a viable technology. The second group consists of the following two lathes:

Identification Number	Size of Gun Barrel Produced	Date of First Use Manufacture of Gun Barrels
WV 2488	175 mm	November 1967
WV 11187	175 mm	October 1972

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The third group consists of four lathes that were ordered from Cincinnati Milacron, Inc., prior to the expiration of the '568 patent but were not fully assembled by Cincinnati Milacron or delivered to the Arsenal until after the '568 patent had expired on November 16, 1982.

Defendant contends that no compensation is appropriate for the first group of lathes for a series of reasons, one of which is that any such claim for compensation would be barred by the statute of limitations. For the second group, defendant relies exclusively upon a statute of limitations bar. As to the third group, defendant contends that the prerequisites for government liability under Section 1498 did not occur until after the '568 patent had expired and, therefore, no compensation is warranted.

II.

As explained above, the first group consists of two guided lathes, the Bergen device and the modified Bergen device. As to the Bergen device, the trial evidence indicates that the Arsenal was no longer using the device on the date the '568 patent was issued. Since the United States did not manufacture or use the device during the time the device was "covered by a patent" (*i.e.*, during the patent term), compensation is not available under Section 1498.

Turning to the modified Bergen device, the Arsenal did use that device during the '568 patent term, but only for about four months and only to bore a small number of gun tubes. Defendant contends that this limited use should be considered *de minimis* and therefore should not be subject to compensation under Section 1498. But Section 1498 mandates reasonable and entire compensation "*whenever*" (emphasis added) there is an unauthorized manufacture or use of a patented invention by or for

the United States. Section 1498 does not contain any exception for short-term use of a patented invention. Hence, in each case, the court must engage in a factual inquiry to determine what constitutes "reasonable and entire compensation." *See, e.g., Decca, Ltd. v. United States*, 225 Ct. Cl. 326, 336, 640 F.2d 1156, 1167 (1980), *cert. denied*, 454 U.S. 819 (1981). As explained in Section VI, *infra*, sometimes that inquiry results in compensation being based on the amount or the nature of the use of the patented invention, but sometimes it does not. The court cannot exclude the possibility of compensation for limited use without first undertaking the required factual inquiry.

III.

Next, as to all guided lathes in the first and second groups, defendant contends that no compensation is available because any claim based on the Arsenal's use of these lathes would be barred by the statute of limitations. Defendant argues that since the instant action was filed more than six years after the Arsenal first began using all of the devices in the first and second groups, suit on each device is barred by the six-year statute of limitations applicable to Claims Court actions.[1]

Defendant is correct that, typically, the date of the first use of a patented invention is controlling when determining whether a claim filed under Section 1498 is barred by the statute of limitations. In *Starobin v. United States*, 229 Ct. Cl. 67, 71, 662 F.2d 747, 749 (1981), the Court of Claims explained that under

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1. 28 U.S.C. § 2501 provides: "Every claim of which the United States Claims Court has jurisdiction shall be barred unless the petition thereon is filed within six years after such claim first accrues."

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Section 1498, a distinct claim arises for each patented device used by the United States, and as to each such device, only one right to recovery against the government arises, *i.e.*, each additional use of the device does not give rise to a new cause of action. Hence, a cause of action under Section 1498 can be brought upon the government's first use of the patented invention, and, typically, the Claims Court statute of limitations under 28 U.S.C. § 2501 would start to run on that date. *See id.*

But this is not a typical case. In *Japanese War Notes Claimants Ass'n of the Philippines, Inc. v. United States*, 178 Ct. Cl. 630, 373 F.2d 356, *cert. denied*, 389 U.S. 971 (1967), the Court of Claims explained that under specified circumstances, the statute of limitations on a claim would not begin to run until the aggrieved party reasonably should have known about the existence of a claim. The court stated:

> Plaintiff must either show that defendant has concealed its acts with the result that plaintiff was unaware of their existence or it must show that its injury was "inherently unknowable" at the accrual date. . . . In this situation the statute will not begin to run until plaintiff learns or reasonably should have learned of his cause of action.

Id. at 634, 373 F.2d at 359 (footnote omitted). *See also Hopland Band of Pomo Indians v. United States*, 855 F.2d 1573, 1577 (Fed. Cir. 1988).

The *Japanese War Notes* prerequisites for delaying the commencement of the running of the statute of limitations are present here. The pertinent facts were presented by the parties

during trial and were discussed to some extent in that portion of the court's prior opinion discussing defendant's laches defense. *De Graffenried I*, 20 Cl. Ct. at 486-90. The most reasonable inference to draw from the trial evidence, and the one that the court draws here, is that government personnel deliberately concealed from plaintiff material facts concerning the government's use of guided boring devices. *Inter alia*, Arsenal personnel "represented that there had not been any change in the facts upon which defendant based its denial of plaintiff's 1968 administrative claim even though, in fact, the Arsenal had developed a guided boring device which already had been used to control the deep boring of an object rotating about an axis." *Id.* at 488. In addition, the government cancelled a previously planned tour of the Arsenal which would have disclosed the structure of the controller device used at the Arsenal.

Defendant contends that even assuming the government did conceal material facts, the statute of limitations commenced to run at least by 1971, because by that time plaintiff reasonably should have learned of his cause of action. Defendant relies upon a letter to plaintiff dated May 28, 1971, from William A. Folsom, an associate of a small company of which plaintiff was a principal. But, as the court explained in *De Graffenried I:*

> [W]hile this reference indicates that in 1971 plaintiff knew there were runout systems being used at the Arsenal, there is no evidence in the record indicating that plaintiff had direct knowledge at that time, or any time prior to 1978, of the physical structure of the controllers used at the Arsenal. Plaintiff could not conclude that his patent was being infringed simply from the Arsenal's use of a runout controller. Plaintiff originated and

> patented one possible concept for controlling runout, and plaintiff was not in a position to conclude that any runout controller developed by the Arsenal would necessarily or even likely be covered by his patent.

Id. at 488-89.

Clearly, notwithstanding defendant's actions, if plaintiff had sufficient information suggesting that the Arsenal was using his patented device, the statute of limitations would have commenced to run and plaintiff would have been obliged to commence suit to determine the remainder of the facts. But here, there was no significant evidence suggesting to plaintiff that the Arsenal device was covered by the '568 patent. As the court explained in its prior discussion of laches:

> [P]laintiff took all of the steps reasonably possible, short of instituting suit, to determine whether the Arsenal was being forthright in its allegations of noninfringement. The structure of the Arsenal device could not be determined by examining a finished gun barrel. Therefore, to determine whether the controllers used at the Arsenal were covered by his patent, plaintiff had to inspect the actual Arsenal device or blue prints depicting its structure. But the Arsenal is a restricted area and plaintiff could not make such an inspection without the Arsenal's authorization. Plaintiff had arranged for an inspection on February 2, 1967, but when plaintiff and his counsel arrived at the Arsenal, the previously granted authorization was

> revoked. Another request had been denied in 1968.

Id. at 489.

Based upon the trial record, the court cannot conclude that plaintiff reasonably should have known about the use of his patented invention at the Arsenal prior to 1978. Hence, the statute of limitations does not bar plaintiff's claim for compensation based on the Arsenal's use of the guided lathes in the first two groups.

IV.

Turning to the third group of guided lathes used at the Arsenal, the four lathes manufactured by Cincinnati Milacron were initially ordered by the Arsenal during the term of the '568 patent but were not delivered to the Arsenal until early 1984, more than one year after the '568 patent had expired. It is well established that the mere entry into a contract to purchase a device covered by a patent does not itself create liability under 28 U.S.C. § 1498(a). *See, e.g., Tektronix, Inc. v. United States*, 216 Ct. Cl. 144, 151, 575 F.2d 832, 836, *cert. denied*, 439 U.S. 1048 (1978). Section 1498 reaches only "use or manufacture" of a patented device by or for the United States, and the execution of a contract to manufacture a device is not the same as the actual manufacture. *Id.*

Plaintiff contends that the production of one of the four machines was sufficiently far along when his patent expired so that the machine should be considered to have been "manufactured" by Cincinnati Milacron for the Arsenal during the patent term. But the court concludes to the contrary. The general rule is that until a device covered by a patent is actually assembled, the device has not

been "manufactured." *Deepsouth Packing Co. v. Laitram Corp.* 406 U.S. 518, 528 (1972); *see also Decca*, 225 Ct. Cl. at 337, 640 F.2d at 1168. In *Paper Converting Machine Co. v. Magna-Graphics Corp.*, 745 F.2d 11, 19 (Fed. Cir. 1984), the court articulated what amounts to a narrow exception to that general rule. But that narrow exception is not broad enough to encompass plaintiff's claim herein.

In *Paper Converting*, Magna Graphics had contracted with a company to deliver a particular device. But prior to manufacture and delivery, a district court held that Magna Graphics had infringed Paper Converting's patent by a previous sale of a similar device to a third party. The district court enjoined Magna Graphics from any future infringement. In an effort to fulfill its obligations under its pending contract without violating the injunction against infringement, Magna Graphics manufactured and then separately tested the two major subassemblies of the device to assure that the device would work. The subassemblies were then delivered to the customer more than six months before the patent expired, but, pursuant to an agreement, the customer did not assemble the machine until after the patent expired. The court labeled Magna Graphics' plan a "scheme to avoid patent infringement," *id.* at 15, and upheld a finding of infringement. The court stated:

> Given the amount of testing performed here, coupled with the sale and delivery during the patent-term of a "completed" machine (completed by being ready for assembly and with no useful noninfringing purpose), we are not persuaded that the district court committed clear error in finding [infringement].

Id. at 19.

Herein, plaintiff has not demonstrated any analogous "scheme to avoid infringement." Cincinnati Milacron did not deliver the guided boring machines in unassembled form during the patent term and there is no evidence suggesting that either completion of the manufacture of the machines or the date the machines were first used by the Arsenal was influenced in any way by the expiration of the patent. While Cincinnati Milacron did manufacture parts of the final product — a boring bar and a boring head — prior to the expiration of the patent, the bar was not yet ready to receive the boring head because certain piping was not installed until after the patent had expired. Moreover, the product had in no sense been tested to the point where it could be predicted to work. Unlike *Paper Converting*, there was no "operable assembly" (*id.*) prior to the expiration of the patent. Indeed, there was no successful testing of the lathes at Cincinnati Milacron until six months after the patent had expired, and there was no successful boring of a usable gun tube until well over a year after the patent had expired. *Paper Converting* considerations are not remotely involved here.

Plaintiff presents an alternative argument for compensation for all four Cincinnati Milacron lathes. Plaintiff argues that had he known about Cincinnati Milacron's contract with the Arsenal, he could have sued Cincinnati Milacron for patent infringement on the grounds that the contract represented a sale of a patented invention within the scope of 35 U.S.C. § 284. Had plaintiff sued Cincinnati Milacron, plaintiff reasons, the government would have compensated Cincinnati Milacron for the damages Cincinnati Milacron would have had to pay to plaintiff. Hence, plaintiff concludes, "reasonable and entire compensation" under Section 1498 should include compensation for these "sales."

This reasoning must be rejected. First, it is based on a faulty premise. It does not appear that plaintiff could have successfully brought suit against Cincinnati Milacron for an infringing "sale" until the product was constructed and ready for use. *Ecodyne Corp. v. Croll-Reynolds Engineering Co.*, 491 F. Supp. 194, 198 (D. Conn. 1979). *See also Lang v. Pacific Marine & Supply Co.*, 895 F.2d 761, 764 (Fed. Cir. 1990); *Lemelson v. United States*, 752 F.2d 1538, 1548 (Fed. Cir. 1985) ("Generally, infringement can occur only when the claimed combination has been assembled and is used or is available for use.")

Second, and more fundamentally, the question here is one of federal government liability under Section 1498, not private liability under 35 U.S.C. § 284. Government liability under Section 1498 arises from the "use [] or manufacture [] by or for the United States." There is no mention of liability for a "sale" to the United States of a device covered by a patent. In contrast, with respect to private liability for patent infringement, the "sale" of a patented device is specifically defined in 35 U.S.C. § 271 as an act of infringement and hence is compensable under 35 U.S.C. § 284.[2]

By authorizing suit against the United States, Section 1498 constitutes a waiver of sovereign immunity (*Decca*, 225 Ct. Cl. at 335, 640 F.2d at 1167). It is well established that any such waivers must be strictly construed. *See United States v. Mitchell*, 445 U.S. 535, 538 (1980). Since Section 1498 does not specifically authorize suits against the United States in instances of a sale of a

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2. Section 284 provides for "damages adequate to compensation for. . . infringement." Section 271 provides that"[e]xcept as otherwise provided in this title, whoever without authority makes, uses or *sells* any patented invention within the United States during the term of the patent therefor, infringes the patent" (emphasis added).

patented device, it would violate the principles of sovereign immunity to interpret the statute as mandating compensation by the United States for such a sale. Hence, the court concludes that no compensation is appropriate under Section 1498 for the four guided lathes manufactured by Cincinnati Milacron.

V.

As the court explained in Sections II-IV, *supra*, plaintiff is entitled to compensation under Section 1498 for the Arsenal's use of seven of the twelve guided lathes used at the Arsenal. The court now turns to the issue of calculating the appropriate "reasonable and entire compensation" for the use of those seven lathes.

Government liability for the unauthorized use of manufacture of a patented invention has its roots in the fifth amendment's prohibition against the unauthorized taking of private property for public use. *Leesona Corp. v. United States*, 220 Ct. Cl. 234, 599 F.2d 958, *cert. denied*, 444 U.S. 991 (1979). Pursuant to 28 U.S.C. § 1498, a patent owner whose patented invention is used or manufactured by or for the United States without a license may bring a suit in the Claims Court and recover from the United States "reasonable and entire compensation." "Reasonable and entire compensation" has two components. *Decca*, 225 Ct. Cl. at 336, 640 F.2d at 1167. The first component is the value of the license that, in effect, was taken by the government. The value is "determined ordinarily as of the time the Government takes the license." *Id.* The second component involves compensation for the government's delay in paying for that license. *Decca* 225 Ct. Cl. at 337, 640 F.2d at 1168. The parties herein agree as to the proper measure of delay compensation. The central dispute involves the value to be placed on the patent license that in effect was taken here.

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In *Decca*, after a review of pertinent precedent, the Court of Claims concluded that "[t]o appraise a patent license taken by the Government, the court utilizes one of three methods of valuation: (1) determination of a reasonable royalty for the license; (2) awarding a percentage of governmental cost savings arising from governmental use of the patented invention; or (3) awarding lost profits." *Id.* at 336, 640 F.2d at 1167 (footnotes omitted). The lost profit method is not a viable alternative here because plaintiff neither manufactured nor sold the patented apparatus and, therefore, did not directly lose any profit as a result of defendant's use of the patented invention.

As to the two remaining alternatives, the *Decca* court classified calculation of a reasonable royalty as the "preferred method" and used that method where "the facts of [the] case [did] not constrain [it] to use a method of valuation different from the preferred method." *Id.* at 345, 640 F.2d at 1172. Herein, plaintiff favors use of the "percentage of governmental cost savings" method, but argues that even if the reasonable royalty approach is employed, the reasonable royalty should be calculated with reference to cost savings. The court will first address the calculation of a reasonable royalty and then address plaintiff's contention that cost savings should be used instead of a reasonable royalty to the extent that the two methods result in different levels of compensation.

VI.

When determining a reasonable patent royalty, a court first assesses whether there is an established royalty rate for the patent. If there is an established rate, that rate typically constitutes the reasonable royalty and is used as "the best measure of reasonable and entire compensation." *Tektronix, Inc. v. United States*, 213 Ct.

Cl. 257, 552 F.2d 343 (1977). In the instant case, there is no such established royalty rate because, despite his best efforts, plaintiff never succeeded in securing a licensee under the '568 patent.

In the absence of an established royalty rate, courts, typically set the reasonable royalty by determining the royalty rate that the parties would have negotiated had they willingly engaged in license negotiations at the time of the taking. *See, e.g., Tektronix*, 213 Ct. Cl. 257, 552 F.2d 343; *Amerace Esna Corp. v. United States*, 199 Ct. Cl. 175, 181, 462 F.2d 1377, 1380 (1972) ("In the absence of an existing royalty rate, courts often resort to a 'willing seller-willing buyer' approach to establish what a reasonable royalty should be under the particular facts with which they are faced. In effect, this requires the synthesization of a hypothetical negotiation at the time of defendant's infringement" (footnote omitted)). The "willing seller-willing buyer" test permits consideration of a broad set of factors, including, in appropriate situations, facts that were not known at the time of the hypothetical negotiation. *Fromson v. Western Litho Plate & Supply Co.*, 853 F.2d 1568, 1574-76 (Fed. Cir. 1988).

Here, the government was using the patented technology on the date the patent was issued, November 16, 1965, and the parties have stipulated that this date should be the date of the hypothetical negotiation. However, the parties disagree as to the type of royalty structure that plaintiff, as a willing seller of a patent license, and the Arsenal, as a willing buyer, would have negotiated on that date.

Plaintiff contends that the parties would have negotiated a license in which the royalty varied based on the Arsenal's actual cost savings resulting from use of the patented invention. The parties would have resorted, plaintiff argues, to a "throughput" or "per-use" royalty pursuant to which defendant's royalty payments would vary based on the number of times it used the patented

invention, *i.e.*, a separate royalty payment, in effect, would have been required for each cannon produced using lathes that employed a control system covered by the '568 patent. Since plaintiff's control system saved money on each cannon bored, a payment for each use of the patented device would tend to result in the total royalty varying with the actual cost savings to the Arsenal.

Defendant disagrees and contends that the parties never would have entered an arrangement that varied the royalty based upon the extent the patented apparatus was used. Rather, defendant argues, the parties would have negotiated a license calling for an up-front payment of a sum certain, plus a one-time royalty for each system the Arsenal used that was covered by the '568 patent.

Review of the evidence presented at trial, including evidence as to industry practice and the parties' subjective intent at the time of the hypothetical negotiation, and an analysis of the potential benefits and costs involved with the use of throughput and per-use royalties, indicate that defendant's view of the outcome of the hypothetical negotiation is correct. The parties would not have negotiated a patent license containing a throughput or per-use royalty.

A.

First, the practice in the machine tool industry at the time of the hypothetical negotiation was that throughput and per-use royalties were not included in patent licenses where, as here, the patent covers an apparatus and the product produced using the patented apparatus is not itself patented. For example, Cincinnati Milacron, a major machine tool manufacturer, has never entered a license on an apparatus patent in which the royalty was based either on the output of the apparatus or on the estimated cost

savings that would result from use of the apparatus. Bethlehem Steel Corporation, a user of machine tools to whom plaintiff turned as a possible patent licensee, has a similar licensing history. It has never entered a license on a machine patent in which the licensee was obliged to pay royalties based upon cost savings from the machine or to make continuing payments based on the value of unpatented products produced by the machine.

During trial, in addition to presenting evidence from individuals employed at firms in the machine tool industry, defendant also presented testimony from a licensing expert who has had significant experience in negotiating licenses in the machine tool industry. The expert, who the court found highly credible, testified that throughput and per-use royalties were virtually never employed in licenses involving patented machine tools.

B.

Second, plaintiff has failed to demonstrate that the parties herein were in any way inclined at the pertinent time to depart from this general industry practice. The evidence does not suggest that plaintiff or defendant had considered throughput or per-use royalties, much less that they would have consented to employ one in licensing the '568 patent. To the contrary, plaintiff's efforts to license his patent were quite consistent with general industry practice. For example, on December 14, 1963, following a meeting with representatives of Westinghouse Electric Corporation, plaintiff prepared a letter summarizing an offer to Westinghouse and responding to some Westinghouse questions. At the time, the controller patent had not yet been issued, but plaintiff anticipated its issuance. In an exhibit to the letter, plaintiff set forth "ball-park" licensing terms. He offered Westinghouse the "exclusive complete

shop rights" to the controller patent (the '568 patent) as well as the "exclusive commercial shop rights" to the indicator patent (issued to plaintiff and Folsom as co-inventors in 1962). Consistent with the industry norm, rather than suggesting a throughput or per-use royalty, the proposal called for a $50,000 initial payment plus a royalty of $2,000 for each device Westinghouse sold that was covered by either patent.[3]

Similarly, in August 1969, plaintiff authorized William Folsom to produce a single runout controller system covered by plaintiff's patents and to sell that system either to Bethlehem Steel or to Streak, Inc. The authorization anticipated that Folsom would charge a royalty rate of six percent of the gross sales price of the system, with five percent going to plaintiff and one percent to Folsom. The six-percent royalty, based on gross sales price, further indicates plaintiff's intention to license plaintiff's patents based on a single royalty payment for each patented apparatus rather than based on a royalty that varies depending on the extent the apparatus is used.

Plaintiff also had negotiations directly with the Arsenal and at no time suggested a royalty based on the extent a patented controller was used. In its 1962 response to the Arsenal's request for proposals, Flight Command Association, a small company of

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3. Plaintiff does not remember actually sending this letter to Westinghouse. But the reasonable conclusion is that he did send it. Plaintiff impressed the court as a person who had a strong desire to license his patents and who worked diligently, even doggedly, toward that end. It is not reasonable to conclude that plaintiff would not have followed up on his meeting with Westinghouse representatives with a written response. There is no evidence to suggest that plaintiff drafted any response different from this letter. In any event, even if plaintiff never sent the letter, its contents would seem indicative of plaintiff's conclusions at that time as to an appropriate licensing scheme.

which plaintiff was a principal and Folsom an associate, bid $46,000 for the manufacture, installation, and testing of a runout controller. Though plaintiff had already filed a patent application on its runout indicator, there was no suggestion in the bid that the Arsenal should pay a throughput or per-use royalty in the event the controller ultimately built was covered by a subsequently issued patent. In 1968, plaintiff offered to license the controller patent to the Arsenal for $1, provided that plaintiff would be able to demonstrate the device to prospective customers. In March 1970, plaintiff offered a license under the '568 patent under the condition plaintiff were given a contract to build a second runout controller for the Arsenal. There was no suggestion in 1968 or 1970 that the license would include a throughput or per-use royalty.[4]

Third, the nature of the technology and the surrounding circumstances similarly do not suggest that the hypothetical negotiation between the parties would have ended with a license containing a throughput or per-use royalty. In evaluating whether, in the course of the negotiation, the parties would have been drawn to the use of throughput or per-use royalties, it is appropriate first to review some of the potential advantages and disadvantages inherent in these types of royalties and then to predict the extent to which these advantages and disadvantages would have affected the hypothetical negotiators' decisions.

In appropriate circumstances, throughput or per-use royalties can be highly efficient and bring benefits to both the licensor and

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4. Plaintiff's son discussed the possibility of employing a throughput or pre-use royalty in a license of the '568 patent in an academic thesis submitted in 1981. But this is long after the date of the hypothetical negotiation and, in any event, the proposal was unsuccessful. No entity indicated a willingness to enter such a license.

the licensee. For example, a per-use royalty can permit a licensor efficiently to vary the royalty charged to different licensees under the same patent. Generally, each licensee will place a different value on a license which would depend upon the financial advantage the patented technology would bring to the licensee, *i.e.*, the impact on the licensee's costs, sales, profits, etc. The more a licensee gains from access to the patented technology, the more it will be willing to pay for a license. One typically significant variable in determining the value of a patent license is the frequency with which the licensee will use the patented invention. Thus, if a patented technology permits the manufacture of gun barrels at a lower cost, the more gun barrels manufactured, the greater the cost saving and, hence, the more valuable the license. A licensing scheme that employs throughput or per-use royalties, therefore, can be an efficient way for the licensor to vary the royalties charged to different licensees according to the value that the license represents to each licensee.

Throughput and per-use royalties can also benefit licensees. For example, a throughput or per-use royalty benefits the licensee by giving it additional control over the total license cost. The licensee has the flexibility to reduce the amount of the royalty payment under the license simply by using the patented technology less.[5] Throughput and per-use royalties also can result in the patented technology becoming available to a greater number of licensees. If the licensor chooses to charge all licensees a single identical fee for each apparatus covered by the patent regardless of

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5. For example, if after entering the license the licensee determines that a new technology is superior to the patented technology for certain uses, the licensee can simply cease using the patented technology for those uses and, in effect, lessen its royalty obligations under the license.

the amount of use, the fee chosen by the licensor in an effort to maximize its profits could well prove too high for certain potential licensees who anticipate comparatively little use of the patented apparatus. These same potential licensees may find a license financially beneficial if instead a throughput or per-use royalty were offered. In this way, throughput and per-use royalties potentially can result in patented technologies becoming available to licensees who otherwise would not have access.[6]

While there are potential benefits, there also are potential problems and costs associated with throughput and per-use royalties. One significant potential disadvantage is an increase in transaction costs for administering the license. A license that involves a fixed payment at the time the license is executed, plus a fixed payment for each patented apparatus used, is typically relatively easy to administer. To monitor compliance, the licensor need only identify each apparatus used by the licensee so as to determine which apparatus are covered by the patent. A throughput or per-use royalty, however, can raise far more complex and costly

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6. A throughput or per-use royalty also permits the licensor and licensee to share the risk of the parties' estimations as to the success of the patented technology turning out to be incorrect. If the patented technology turns out to be not as successful as predicted, it will be used less, the licensee will benefit less from the license, and the patentee will receive lower royalties. On the other hand, if the technology turns out to be more successful, the technology typically will be used more, the licensee will benefit more, and the patentee will receive higher royalties. A license based on a single up-front payment would involve no such sharing of risk. In such cases, if the patented technology turns out to be more successful than the parties anticipated, only the licensee benefits. It agreed to pay a fixed fee and is required to pay no more. On the other hand, if the patented technology turns out to be worthless, only the licensor benefits. It keeps the license payment while the licensee in effect secures no financial benefit from the license.

administration problems. To monitor compliance, the licensor would have to monitor the licensee's actual use of each patented apparatus. Developing such a monitoring system can prove difficult and costly. Indeed, firms typically do not want outsiders either on their factory floor continually watching production or looking at the firm's confidential records that discuss quantities of production.

Another potential disadvantage of throughput and per-use royalties involves the inherent unpredictability of the timing and total amount of royalty payments. For example, when a throughput or per-use royalty is employed in licensing a patent covering an apparatus, the total amount of payment for the license is indefinite at the time the license is signed and remains indefinite through the time all patented machines have been purchased and used up until the patent expires. Some licensors, including small operations like plaintiff's, may prefer a more immediate and more definite payment of royalties.

A major disadvantage of throughput and per-use royalties is that unless the cost savings resulting from the patented technology is known with some certainty at the time of the license, it can prove difficult for the parties to agree as to the amount of likely cost savings and, hence, as to the amount of the royalty that should be paid for each use of the patented apparatus. On this point, defendant's expert testified to the effect that throughput and per-use royalties are more commonly used in the licensing of chemical processes, where the licensor has fully developed the patented process and can demonstrate expected savings to the licensee. The cases upon which plaintiff and his licensing expert relied are generally consistent with this testimony of defendant's expert. These cases typically involve licensing of patents that contain process or method claims in addition to apparatus claims and cover

developed technologies. In *Horvath v. McCord Radiator & Mfg. Co.*, 100 F.2d 326 (6th Cir. 1938), *cert. denied*, 308 U.S. 581 (1939), the patent included method claims and, in addition, the patent owner had previously licensed the patents using a throughput royalty. In *Binks Mfg. v. Ransburg Electro-Coating Corp.*, 122 U.S.P.Q. 74 (S.D. Ind. 1959), *aff'd in part and rev'd in part*, 281 F.2d 252 (7th Cir. 1960), the patent contained process as well as apparatus claims and the process had been fully developed at the time of licensing. Indeed, the patent owner was able to support a per-use royalty by demonstrating the cost savings to the licensee in a pilot operation. The patents involved in *Brulotte v. Thys Co.*, 379 U.S. 29 (1964), and *Dixie-Vortex Co. v. Paper Container Mfg. Co.*, 43 F. Supp. 518, 522-23 (N.D. Ill.), *aff'd in part and rev'd in part*, 130 F.2d 569 (7th Cir. 1942), similarly covered inventions that were fully developed in working machines prior to the alleged infringer's use of them.

When the potential benefits and costs associated with throughput and per-use royalties are evaluated in the context of the particular facts of this case, the court cannot conclude that during the hypothetical negotiation, the parties would have been drawn to the use of throughput or per-use royalties. First, at the time of the negotiation, plaintiff was seeking to maximize the initial payment in order to get his fledgling business going. It is not apparent that plaintiff would have agreed to a throughput or per-use royalty in view of the indefiniteness as to the timing and amount of payment. Second, the number of cannons manufactured at the Arsenal is potentially sensitive information and it is not clear that the Arsenal would have agreed to a monitoring system that would have provided this information to plaintiff on an ongoing basis.

But even more significant than these first two points is that at the time of the hypothetical negotiation, the patented technology

was still in the process of being developed. Hence, it was not possible for the parties, with any reasonable degree of certainty, to predict the cost savings that ultimately would result from use of the patented technology in the boring of large tube cannons. In this setting, the parties likely would not have been able to agree as to the appropriate royalty to be charged for each use of the patented device or each cannon put through the device.

Given the industry practice, plaintiff's subjective intent, and the benefits and cost of throughput and per-use royalties, the court concludes that had the hypothetical negotiation occurred, the parties would not have departed from industry practice and employed a throughput or per-use royalty. Instead, the hypothetical negotiation would have resulted in the type of license typically used in the machine tool industry where there is an up-front payment of a significant specified sum, plus a royalty payment for each apparatus covered by the patent that was manufactured or used by the United States during the patent term. Hence, the court will use such a compensation structure for determining a reasonable royalty here. *See, e.g., Stickle v. Heublein, Inc.* 716 F.2d 1550, 1561-63 (Fed. Cir. 1983), where in a patent infringement action, the Court of Appeals for the Federal Circuit reversed the district court's award of damages based on a per-use royalty calculated from cost savings where the industry practice was not to use such royalties and the evidence did not support a conclusion that the hypothetical negotiation would have resulted in a per-use royalty.

VII.

Next, plaintiff contends, in effect, that assuming the reasonable royalty analysis does not result in a royalty based on cost savings, the court should reject the reasonable royalty approach and instead base the royalty directly on an appropriate

percentage of the cost savings that did result. But assessing the reasonable royalty is the preferred method and plaintiff has not presented any compelling facts that would "constrain [the court] to use a method of valuation different from the preferred method." *Decca*, 225 Ct. Cl. at 345, 640 F.2d at 1172.

Moreover, a reasonable royalty analysis based on a hypothetical negotiation seems particularly appropriate in Section 1498 cases. Unlike with private litigants, a patent holder cannot prevent the government from using its patented invention. "The Government has a right to take patent licenses and cannot be enjoined from doing this." *Decca*, 225 Ct. Cl. at 335, 640 F.2d at 1166. Therefore, with respect to the federal government, a patent owner, in effect, has no choice but to be a licensor; the sole issue is the appropriate royalty payment due. Thus, the Section 1498 suit, in a sense, is a substitute for royalty negotiations that should have taken place at the time the invention was first manufactured or used by or for the government. In this context, it seems particularly appropriate to base the royalty on the outcome of a hypothetical negotiation that would have occurred at that time.[7]

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7. One additional point on cost savings is worthy of discussion, though the point was not decisive in this court's decision to rely upon the reasonable royalty method.

Contrary to plaintiff's allegations, quantifying the cost savings directly attributable to plaintiff's patented invention would not be a simple and straightforward matter here. To support its contention of cost savings, plaintiff relies in substantial part upon a report by an Arsenal employee who helped design and manufacture the guided boring devices used at the Arsenal. The report, written in February 1975, estimated that the new method employed at the Arsenal using a guided bore had saved the Arsenal $2.8 million in the manufacture of gun barrels. But there are two problems with relying on the $2.8 million figure as a measure of cost savings here. First, the "new method" did not involve simply modifying the "old method" so as to use the technology covered by the '568 patent. In order to produce

(Cont'd)

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VIII.

Next comes the task of setting the appropriate compensation, *i.e.*, establishing and applying the reasonable royalty. The best indication of the royalty that would have resulted from the hypothetical negotiation is plaintiff's 1963 letter to Westinghouse in which he offered a license with considerable exclusivity for $50,000 plus a royalty of $2,000 per system. In light of Flight Command Association's 1962 offer to the Arsenal to manufacture and install a runout controller for $46,000, this proposed $2,000 royalty would represent approximately five percent of what plaintiff had believed to be the cost of a runout controller.[8] The court concludes that had the hypothetical negotiation between the Arsenal and plaintiff occurred, the parties generally would have followed this formula of the Westinghouse letter.

(Cont'd)
the guided boring device that it ultimately used, the Arsenal had to solve a series of complex technological problems that were not addressed in plaintiff's patent. Neither party quantified the extent to which the $2.8 million in cost savings was attributable to the Arsenal's own technological developments rather than to plaintiff's invention.

Second, the $2.8 million figure was based on a comparison of costs associated on the one hand with a new guided boring system used at the Arsenal for manufacturing 175 mm gun barrels. Apparently, a third technology, rapid boring, was developed at the Arsenal and was more efficient than conventional boring. Any calculation of cost saving at resulted from the Arsenal's use of plaintiff's patented technology should compare plaintiff's patented technology with the next most efficient technology available to the Arsenal. At least during some of the relevant time, rapid boring was viable, available, and the second most efficient technology.

8. The court concludes that the parties would not have included in the royalty base the cost of the lathes upon which the patented bore guidance devices were installed. The evidence, including the Westinghouse license offer and the Folsom authorization, indicates that plaintiff envisioned the controller being marketed as an add-on to existing lathes.

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Hence, the hypothetical negotiation would have ended with plaintiff receiving an up-front payment of $50,000 adjusted for inflation between the date of the Westinghouse letter and the date of the negotiation, plus five percent of the cost the Arsenal would have had to pay an outside firm to manufacture and install a controller system on the existing lathes at the Arsenal. Since the Arsenal did the work in-house, it is appropriate to add to the in-house costs a profit margin of ten percent to account for profit that would have had to be paid had the work been done by an outside firm. Based upon the best available information in the record concerning such costs, the court concludes that the five percent royalty should be applied as follows:

	Cost of Conversion	Profit Factor	Total Conversion	5% Royalty
Modified Bergen Device	$60,000	$6,000	$66,000	$3,300
WV 2488	79,523	7,952	87,475	4,374
WV11187	183,650	18,365	202,015	10,101
WV11235	75,000	7,500	82,500	4,125
WV11205	91,203	9,120	100,323	5,016
WV11225	98,164	9,816	107,980	5,399
WV11190	105,173	10,517	115,690	5,785

Thus the court is awarding compensation for the modified Bergen device even though the device was used only for a short period of time. As explained above, defendant contends that there was only *de minimis* use of the modified Bergen device and therefore no compensation is warranted. But in making this argument, defendant in a sense wants it both ways. Defendant argues against plaintiff's efforts to employ a per-use royalty on the grounds that the parties would not have focused on the amount of use had they entered negotiations for a license. But then defendant

turns around and seeks to avoid any compensation for the modified Bergen device based on the low amount of use. In effect, defendant wants the amount of use considered when it benefits defendant, but ignored when it works to its detriment.

The court rejects this approach. As summarized above, the appropriate method of analysis is with reference to a hypothetical licensing negotiation in November 1965. The court concludes that during such a negotiation, the parties would not have carved out a compensation exception for controllers used for a comparatively short period of time, even those used exclusively for developmental purposes. The evidence indicates that plaintiff would have sought remuneration for each device covered by the patent that was manufactured or used and it therefore is appropriate to treat the modified Bergen device in the same manner as all other devices for compensation purposes.

CONCLUSION

For the reasons set forth above, plaintiff is entitled to "reasonable and entire compensation" for seven of the twelve guided lathes used at the Arsenal. As discussed above, their are two components to "reasonable and entire compensation": (1) the value of the patent; and (2) the compensation due as a result of the government's delay in paying for its use of the patented device. As to the value, plaintiff is entitled to $50,000 adjusted for inflation between December 14, 1963, and November 16, 1965, plus a five percent royalty for each of the seven lathes as set forth in Section VIII, *supra*. As to delay compensation, the parties have agreed as to the appropriate method of calculation. Accordingly, on or before March 2, 1992, the parties shall file a stipulation as to the appropriate delay compensation and the appropriate total award based on the findings and conclusions set forth above. In a separate

order, the court will order that judgment be entered for that amount.

IT IS SO ORDERED.

s/ Roger G. Andewelt
ROGER G. ANDEWELT
Judge